

The Wyoming Mule Deer Initiative



Prepared by the Mule Deer Working Group,
Wyoming Game and Fish Department



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PREFACE

Drafting the Mule Deer Initiative was a collaborative effort by the Wyoming Game and Fish Department's Mule Deer Working Group (MDWG). The MDWG was established in Spring, 1998 to explore solutions to the many challenges confronting mule deer managers today. The development of a statewide management initiative was a natural progression from other important projects the group has completed, including an outreach effort to inform the public about the major issues affecting mule deer in Wyoming, completing Herd Unit audits statewide, assembling a library of mule deer literature, mapping key habitats, hosting the 2003 Deer/Elk Conference, representing the Department on the Western Association of Fish and Wildlife Agency's (WAFWA) Mule Deer Working Group, and participating on the Governor's Big Game License Coalition.

This Initiative is tiered from the WAFWA's North American Mule Deer Conservation Plan (Mule Deer Working Group, 2004). Many of the management challenges we face in Wyoming also impact mule deer throughout their range in the United States, Canada, and Mexico. For that reason, similar initiatives or management plans are being developed in other States and Provinces.

On the surface, managing mule deer would seem a relatively simple and straightforward task. In reality a myriad of complex factors affect mule deer populations throughout their range. This Initiative will lay the groundwork for future conservation and management of mule deer in Wyoming. Many of the objectives and strategies we advocate are currently recognized and being implemented within the Department's existing management programs. Others will provide an essential means of adapting to the changing environmental and social pressures affecting mule deer and their management in Wyoming.

It is important for us to recognize our understanding of mule deer ecology and management is incomplete. As the knowledge base continues to grow, this Initiative and the Department's mule deer management program will be appropriately adjusted and adapted to apply new, more effective techniques and strategies that enable us to improve management of this valuable resource.

The intent ultimately is to develop individual management plans or strategies for key herd units based on the overarching goals and objectives outlined in this document. These herd unit plans will identify specific issues, opportunities, and management actions on a localized level. Success and implementation of these plans will depend on our ability to identify limiting factors to mule deer populations and their habitats, available funding, cooperation of Federal land management agencies and private landowners, and public support.

MULE DEER IN WYOMING

By all accounts, mule deer had reached their maximum abundance during the 1950s and 60s. In the last decade of the 20th century and the first decade of the 21st Century, the species appears to have declined markedly throughout the West. In 2005, about 480,000 mule deer inhabited Wyoming.

Densities of mule deer vary greatly across the species' range. Some productive habitats support comparatively dense deer populations, whereas other habitats only sustain sparse deer numbers. In addition, many formerly productive habitats have been depleted by historically overabundant deer herds and altered by human-caused habitat losses, degradation, or fragmentation. Controlled harvest is an essential tool managers use to regulate deer populations. Without it, deer typically increase until they overuse the available forage, leading to a higher likelihood of disease and weather-related mortality. Under such conditions, deer are prone to "boom and bust" cycles, increasing to unhealthy levels and then declining abruptly to extremely low numbers. Recovery of habitat conditions following boom cycles can be a very lengthy process. In light of today's land use changes, habitat conditions, and the public's expectations, allowing extreme boom and bust cycles to occur is not acceptable mule deer management. The Wyoming Game and Fish Commission establishes harvest quotas and season frameworks to maintain sustainable deer populations in balance with the amount and condition of key habitats, and to manage numbers and distribution of hunters.

Mule deer and other big game in Wyoming are managed based on a "herd unit" (or population) concept. A herd is a distinct population of deer engaging in very little breeding or interchange with other herds. Individual herds tend to remain in certain geographic regions (although the regions can be quite large), and use traditional birthing areas, summer habitats, and winter ranges from year to year. Herd sizes vary from only a few hundred in the smallest herds, to tens of thousands in the largest. Herds of free-ranging mule deer inhabit all parts of Wyoming. The map on page 2 depicts the 39 mule deer herds recognized in Wyoming. Within the range of a given herd, the Game and Fish Department may also establish one or more hunt areas in which specific harvest regulations are prescribed.

All mule deer in Wyoming are "free-ranging" and depend predominantly on adequate natural habitats. Development and other activities that disturb even a small portion of a herd's seasonal ranges can have major, population-level consequences. For example, many deer herds migrate to traditional winter ranges where they can move about more freely to find food and cover when deep snow accumulates on summer ranges. Winter ranges tend to be much more limited in area, forcing deer to congregate at much higher densities. Thus, a comparatively small loss of winter range can be as destructive as a much larger impact on summer range. Similarly, developments that disrupt a traditional migration route to winter or summer ranges can jeopardize a large segment of the herd.

Mule deer have evolved over thousands of years and are physically adapted to Wyoming's rigorous climate. However, weather patterns can become so severe at times even this is not enough to ensure mule deer over-winter survival. The most extreme impacts happen when two or more stressful climatic events (e.g., summer drought or cold winters with periods of prolonged, deep snow) coincide. For example, drought cycles reduce the amount and quality of forage and cause water sources to dry-up. During these harsh conditions, deer are unable to accumulate sufficient fat reserves and they enter the winter in poor condition. Inevitably, weakened deer succumb to higher mortality, especially under normal to severe winter conditions.

Mule deer populations fluctuate naturally in response to climate and other environmental variables. Historically, deer habitat was in much better condition and populations rebounded quickly after comparatively short-term declines. However, in recent years Wyoming's landscape has changed drastically and habitats have been altered in ways that are relatively permanent. New and upgraded highways, housing developments, ranchettes, oil/gas fields, reservoirs, and other large-scale developments are fragmenting deer ranges and removing sizeable areas from production. Recent political and economic circumstances have also given rise to unprecedented natural gas development, causing habitat to be altered at a much greater rate than can be restored by reclamation. This impact is exacerbated by other long-term pressures on the land, including drought and heavy utilization by ungulates (both wild and domestic), causing a general decline in the condition and quality of the remaining habitats. A key objective of the Wyoming Mule Deer Initiative is to improve the public's awareness of the issues affecting mule deer to promote conservation of the species and its habitat into the future.

THE MULE DEER INITIATIVE

The Wyoming Mule Deer Initiative (WMDI) outlines the issues affecting deer management now and in the future, identifies appropriate goals and objectives to address mule deer management issues, and recommends strategies to improve mule deer management in Wyoming. The recommended strategies include a broad range of program-level actions with statewide applicability. While much is yet to be done, examples (not an all inclusive list) of management actions implemented to address many of the issues and strategies are provided. The intent ultimately is to develop individual management plans or strategies for key herd units based on the overarching goals and objectives outlined in this document. These herd unit plans will identify specific issues, opportunities, and management actions on a localized level. Success and implementation of these plans will depend on our ability to identify limiting factors to mule deer populations and their habitats, available funding, cooperation of Federal land management agencies and private landowners, and public support.

The WMDI is intended to focus efforts and available resources by emphasizing the following conservation goals:

1. Conserve, enhance and restore mule deer habitat essential for population maintenance, reproduction and survival;
2. Through hunting frameworks, manage wildlife populations to sustain productive habitat conditions, resilient mule deer populations, and recreation opportunity;
3. Apply the best available science, within budgetary considerations, to monitor deer populations and habitat conditions. Improve techniques and increase monitoring efforts as appropriate.
4. Develop cooperative working relationships with universities and other institutions to conduct applied research needed to improve deer management;
5. Inform and educate the public at large, deer hunters, landowners, public officials, government agencies, and others regarding issues and opportunities affecting conservation of mule deer; and
6. Enhance funding and public support for mule deer management.

Mule deer in Wyoming have important aesthetic, cultural, economic, and ecological values. The species thrives in habitats ranging from salt desert shrublands to alpine tundra. Researchers and wildlife managers generally concede the species achieved its maximum abundance during the 1950s and '60s. Since then, mule deer have declined across the West and in Wyoming. The most recent decline happened during the early 1990s and, though not fully understood, it is believed to be primarily due to the combined effects of drought and severe winters. Historically, deer populations rebounded quickly after such climatic extremes. However, in recent years, production and survival of fawns have remained at depressed levels. Low recruitment, severe winters (1992/93 and 2001/02), several dry

summers, changing predator/prey relationships, and increased habitat loss have pushed deer populations lower than the Department and public desire.

Limiting factors affecting mule deer populations are:

1. Altered fire intervals, invasive plants, and historically heavy use by ungulates (both wild and domestic) have and are causing long-term declines in productivity of many deer ranges.
2. Habitats are being converted and fragmented by expanding human populations, urbanization, increased recreational activity, mineral and energy development, and other intensive uses of the land.
3. Climatic extremes such as drought and severe winters impact quality and quantity of habitat and recruitment of mule deer fawns to breeding age. Biologists and researchers are also considering long-term implications of global climate change.
4. Interaction with elk, white-tailed deer, other wildlife species, wild horses, and domestic livestock can negatively affect mule deer and may become more critical when condition and availability of habitats decline or where important habitats are limited.
5. Predation is a natural environmental pressure that acts in concert with habitat conditions and alternate prey availability. In many ecosystems, mule deer coevolved with, and are preyed upon by multiple predator species such as mountain lions, coyotes, black bears, grizzly bears, and wolves. However, habitat quantity and quality ultimately determine the numbers of deer that can be supported. Although predator control may be beneficial in local, specific situations it can actually damage the habitat base by increasing deer above the numbers the habitat can support at any given time. Conversely, when mule deer populations are suppressed at levels below carrying capacity by predation, predator control can be beneficial and allow the mule deer population to increase.
6. Hunting frameworks can alter the size of a mule deer population and its age and sex structure. License allocation systems (e.g., general vs. limited quota) and season structures also affect hunting quality, hunting opportunity, and our ability to manage deer populations.
7. At times, diseases such as epizootic hemorrhagic disease (EHD) and chronic wasting disease (CWD) cause significant deer mortality. However, the actual impacts of such events are not fully understood. By monitoring disease outbreaks and prevalence, managers will improve their capability to predict potential changes in mule deer populations and forewarn hunters and others about the presence of disease.
8. Off highway vehicle access, ATV, and snowmobile use have increased markedly in the past decade. This type of disturbance reduces habitat use during peak recreational activity, such as hunting seasons, by displacing mule deer into marginal habitats. In addition, ATV use detracts from the quality of hunting and reduces hunter success, thereby impacting management goals.

9. Access to private lands and landlocked public lands is greatly restricted in some portions of the state. This reduces hunting opportunity and ability to manage mule deer populations.

Wildlife managers obviously cannot control weather or other long- and short-term climatic changes. Our most fundamental role is to prescribe hunting frameworks needed to manage mule deer populations within the capability of the habitat, in order to lessen the effects of weather and other factors, and to provide a variety of hunting recreation opportunities. We also consult with land management agencies and private landowners to promote programs to protect and improve existing habitat and to mitigate adverse impacts caused by mineral and energy production, as well as other intensive developments and land uses. Where predation and competition with other wildlife are shown to have additive impacts on mule deer, we consider cost-effective means to reduce these impacts.

We address 10 major issues to accomplish the WMDI goals:

1. Habitat Management;
2. Population Management (includes harvest and hunter management);
3. Predator Management;
4. Diseases and Parasites;
5. Law Enforcement;
6. Weather;
7. Elk and Deer Interactions;
8. Public Involvement and Outreach;
9. Research; and
10. Funding and Support.

The Wyoming Game and Fish Department is committed to continually assess and improve its mule deer management program. Given sufficient resources to implement the recommendations in this initiative, we can enhance our ability to manage mule deer populations and provide quality mule deer hunting in Wyoming.

Habitat Management

In his book, Mule and Black-tailed Deer in North America, Wallmo (1981), stated *“In my view, the only generalization needed to account for the mule deer decline throughout the West is that practically every identified trend in land use and plant succession on the deer ranges is detrimental to deer. Hunting pressure and predators might be controlled, and favorable weather conditions could permit temporary recovery, but deer numbers ultimately are limited by habitat quality and quantity.”* Society wants wildlife populations managed at optimal and sustainable levels for inherent aesthetic values, recreation, sport harvest, and scientific purposes. But, habitat managers often find it difficult to convince wildlife enthusiasts that sustaining wildlife populations, including mule deer, at desired levels is rendered difficult and sometimes impossible, because human impacts have eliminated or otherwise negatively altered important deer habitats. The Mule Deer Working Group of the Western Association of Fish and Wildlife Agencies (WAFWA) defines habitat as those resources and conditions present in an area that allow an animal or population to live, survive and successfully reproduce (deVos et al. 2003). The basic components of habitat include food, water, cover, and open space within reasonable proximity. The maximum number of deer an area can support and sustain over time is commonly called “carrying capacity,” and is determined by the amount of food, cover and water available in an area that are available to support a given number of deer over time. When a mule deer population outstrips the available food supply, the herd has exceeded the habitat’s carrying capacity. Body condition and productivity typically decline. Chronic overuse diminishes the ability of the habitat to support deer and may alter the composition and productivity of vegetation for many years.

Food is a key factor influencing how deer use their habitat. The characteristics that most influence the kinds of plants deer select seasonally are palatability, availability, and succulence. Mule deer forage mainly on shrub leaves, buds and stem tips from late summer through fall and winter. In spring through early summer, they rely more on forbs (broad leafy plants) and grasses, which are green, succulent, and high in protein. Food resources can affect mule deer in two primary ways, one arising from quantity and the other from quality. Although mule deer require a certain quantity of forage to survive, large volumes of low quality forage may be inadequate to support the herd. Deer must obtain sufficient energy, protein, and nutrients such as calcium and phosphorus from the plants they eat to maintain body condition and to reproduce successfully. Nutrition influences overall body condition, ovulation, conception, gestation, lactation, survival, and home range size on a seasonal and annual basis. Nutrition also affects winter survival, size at birth, timing of birth, survival of fawns, and even sex composition of fawns. For example, does in good condition bear healthier fawns, more twins, and a higher proportion are females. Does under nutritional stress often give birth to smaller fawns, often later in the season predisposing them to increased mortality. Nutritional status also affects a deer’s vulnerability to predation, as well as its ability to compete for food and survive when severe weather persists for extended periods. Finally, mule deer have a relatively small rumen and digestive tract, which decreases their ability to withstand rapid changes in diet composition. Consequently, while

supplemental feeding can save some deer, it is an inefficient and often times ineffective means of increasing deer survival during severe winters. However, the primary cause for winter starvation is poor habitat conditions and sometimes too many deer. Nevertheless, there have been and undoubtedly will be some winter conditions so severe that if feeding is not implemented entire subpopulations could essentially be lost. In these situations, feeding programs need to be implemented as far in advance as feasible of the onset of malnourishment and usually require a long-term (three to four month) feeding commitment. When such actions are being considered, mule deer managers need to also consider the potential impacts of increased disease prevalence due to increased deer densities and disruption of mule deer movement patterns and migrations. The Wyoming Game and Fish Department recognizes some winters are so severe that regardless of habitat quality or availability significant mortality of mule deer will occur. The Department developed criteria for managers to use when evaluating whether or not to implement a feeding program (Appendix 1).

Water is another critical element of mule deer habitat. Intake varies depending on temperature, humidity, water content of forage, rate of forage consumption, and other factors. Deer generally obtain much of the water they need from succulent forage, however, free water is important when deer consume large amounts of cured vegetation and when does are lactating. In winter, deer normally obtain sufficient water by eating snow. Optimally, water sources for mule deer are spaced no more than approximately 2.5 to 3 miles apart.

Cover is the other major physical component of deer habitat. Types of cover include thermal cover used to minimize exposure and energy loss and security or escape cover used to avoid detection to evade predators and even to avoid harvest by hunters. Mule deer are adept at using trees and shrubs as security cover. Topographic features such as canyons, rocks and river breaks also provide cover. Cryptic coloration greatly enhances the ability of mule deer to hide, making them difficult to detect even when they are standing in the open. Most features that will hide a mule deer also afford thermal protection from wind and cold weather.

Historical accounts give the impression mule deer were confined largely to canyons and sagebrush breaks within the semiarid West. In reality, they occupy a wide range of habitats that include riparian corridors, juniper/ponderosa pine breaks and ridges, brushy foothills, high elevation timber and parks, and at times, alpine tundra and talus slopes above timberline. In some regions, mule deer seasonally utilize farm croplands. This is especially true where farmlands adjoin ancestral wintering areas or where succulent native vegetation is unavailable in summer and fall. At times mule deer make extensive use of cultivated crops but rarely rely entirely on them.

Numerous factors have contributed to loss and fragmentation of mule deer habitats in Wyoming. Some of the more obvious include: energy and mineral exploration and extraction; urban growth and rural subdivision development; natural events such as precipitation, drought, severe winters, and wildfires; construction of highways, railroads, fences, large reservoirs and other impediments to migration; and increased recreation activities such as snowmobiling and off-highway vehicle use. Global climate change may

also be exacerbating several of these effects (deVos and McKinney 2007). These disturbances impact the effectiveness of seasonally important habitats, leading to increased mortality, reduced reproductive success, and displacement of mule deer into less suitable areas.

Mule deer habitats are also altered by many land management practices including fire suppression, grazing by livestock, shrub eradication projects, and activities that increase spread of cheatgrass and other invasive plants. Ungulate browsing pressure (both by wild and domestic animals) and loss of natural fire cycles have led to a decline in the quantity and condition of important habitats, particularly aspen and mixed-mountain shrub communities. Shrub eradication projects designed primarily to increase grass production have reduced availability of shrubs that provide essential food and cover, especially on mule deer winter ranges. Invasive plants such as cheatgrass, knapweed, thistle, and others are increasingly out-competing native shrubs, forbs and grasses on important deer ranges. Some of these weeds ignite easily and tend to increase the frequency and intensity of damaging wildfires that can eliminate native shrubs and other plants. Juniper and conifer stands can provide important deer cover, but reduce sunlight and moisture reaching the more important understory vegetation. When these species expand into important shrub-dominated habitats, they often out-compete and eliminate important forage plants.

In recent years, recurring drought has reduced the amount and quality of forage produced on many deer ranges, resulting in greater competition for the remaining food supply. Increased deer survival during mild winters has exacerbated competition for forage and contributed to declining habitat conditions. Dry conditions have also increased the frequency of wildfires, which often burn so hot they damage the plant communities that provide cover and food. In addition, invasive plant species such as cheatgrass often increase following wildfires. Once they become established, invasive plants often increase fire frequency and competition with native plant communities.

Mule deer habitat can also be enhanced through habitat alterations. Some agricultural practices and progressive livestock management benefit mule deer by increasing shrub productivity and vigor and enhancing the herbaceous (forb and grass) component in the understory. Vegetation manipulations, including mechanical and chemical treatments, prescribed fire, and re-seeding can also be designed to improve and rehabilitate deer habitats.

Vegetation monitoring is absolutely essential to detect ecological trends and to effectively protect and manage deer habitats at risk from ongoing and escalating impacts. Such a program can be very costly and labor intensive to implement on a meaningful scale. However, evaluating habitat conditions and maintaining adequate amounts of high quality habitat are vital to sustain healthy mule deer herds. Managers continue to explore and refine techniques for estimating carrying capacity and evaluating habitat conditions in order to improve Wyoming's mule deer ranges.

The following management objectives and strategies are recommended to sustain the quality

habitat base needed to support abundant mule deer populations for future generations.

Objective: Use an integrated approach to balance the habitat needs of mule deer and other species when planning and implementing habitat management projects.

Strategy: When habitat treatments are planned in crucial mule deer habitats such as shrub-dominated winter ranges, but the treatments are intended primarily to benefit other species, proponents should evaluate short and long-term effects on mule deer before treatments are implemented.

Strategy: Habitat management plans designed primarily to benefit mule deer should include a detailed analysis of the effects treatments may have on other species such as sage grouse, pronghorn, neo-tropical migratory birds, etc., which are dependent on sagebrush.

What's been done:

- ✓ *The Conservation Assessment of Greater Sage-Grouse and Sagebrush Habitats was completed in June, 2004 and has been posted on the Department's public web site. This document provides recommendations and cautions with respect to sagebrush treatments within areas occupied by sage-grouse.*
- ✓ *The Western Association of Fish and Wildlife Agencies published the draft Greater Sage-grouse Comprehensive Conservation Strategy in December, 2006. This strategy also made extensive reference to:*

Connelly, J.W., M.A. Schroeder, H.R. Sands, and C.E. Braun. 2000. Guidelines for managing sage grouse populations. Wildl. Soc. Bulletin. 28(4):967-985.

- ✓ *To address the increasing problems and issues affecting sagebrush-dominated ecosystems and their unique assemblages of wildlife, the Department created a Sage-grouse Coordinator position in 2003. A major function of this position is to coordinate with local sage-grouse working groups and federal agencies to assist with habitat management and land use plans. Our intent is to have the position evolve into a sagebrush-steppe ecologist who will address the full spectrum of species within that ecotype.*
- ✓ *The Department's Nongame Section houses reports and databases containing information about nongame bird and mammal species that inhabit shrubland and grassland ecosystems. Nongame biologists provide technical assistance in assessing potential impacts of habitat treatments and in recommending treatment alternatives that are compatible with nongame species.*
- ✓ *The Comprehensive Wildlife Conservation Strategy (CWCS) was approved by the Wyoming Game and Fish Commission in July, 2005 and is now posted on the Department's public web site. The Strategy lists species of greatest conservation*

need throughout Wyoming, including species inhabiting sagebrush and grassland ecosystems, and recommends conservation actions.

- ✓ *“Wyoming Guidelines for Managing Sagebrush Communities with Emphasis on Fire Management” was completed in November, 2002 and has been posted on the Department’s public web site. The guidelines examine a range of ecological issues that affect sagebrush ecosystems and recommend treatment alternatives.*

Objective: Implement vegetation management practices and treatments to enhance and or protect mule deer habitat on a landscape scale, while considering both ecological and economic impacts.

Strategy: Conduct research and monitoring needed to better understand shrub ecology, the role of fire, and how vegetation responds to treatments designed to enhance wildlife habitat, mitigate impacts, or restore degraded communities. Focus research in sagebrush steppe, mountain shrub, aspen, conifer and riparian habitats

Strategy: Apply appropriate treatments to maintain health and productivity of mule deer seasonal ranges.

Strategy: Work cooperatively with land management agencies to implement monitoring programs that will detect and document potential decline or conversion of important habitats, especially on winter ranges, and take appropriate action to avoid, minimize, or mitigate the impact.

Strategy: Ensure security cover requirements of mule deer are considered in all vegetation management plans.

Strategy: Provide long-term protection of important mule deer habitats through land acquisitions or conservation easements.

Strategy: Work cooperatively with the Federal land management agencies to develop fire management plans/policies that, under appropriate conditions, allow natural ignition fires to burn when they will benefit mule deer.

Strategy: Provide comments and recommendations to assure timber sales and other management activities are designed to maintain or enhance mule deer habitat.

Strategy: Work cooperatively with private landowners (ranchers/farmers) to provide technical and financial assistance to enhance mule deer habitat.

Strategy: Coordinate with wildlife agencies in neighboring states to cooperatively manage important habitats and to share habitat management techniques and strategies.

What's been done:

- ✓ Recent habitat improvement projects that have been implemented include:
 - South Wind River mule deer habitat inventory and treatments;
 - Meeteetse/Owl Creek mule deer habitat inventory and treatments;
 - Horse Creek mule deer habitat inventory and treatments;
 - Big Piney/LaBarge habitat assessment and treatments;
 - Richeau Hills shrub treatments;
 - Snowy Range and Shirley Mountain area assessment;
 - The Department participates in several Coordinated Resource Management teams.
 - The Department has funded a position to administer the Landowner Incentive Program.
 - The Department in conjunction with the NRCS has created 4 Habitat Extension Biologist positions.
 - Middle Fork Powder River habitat assessment and treatments.
 - Bighorn National Forest south slope prescribed burn program.
 - Lake DeSmet habitat restoration program utilizing the Lawson aerator to rejuvenate and re-seed 4-wing saltbush and winterfat.

Objective: Identify areas at risk, where the cumulative effects of natural events and human activities have diminished, or threaten to diminish quantity and quality of mule deer habitats.

Strategy: Develop a Geographic Information System (GIS) based map and database of historic, ongoing and future disturbances within important mule deer habitats to provide a basis for assessing cumulative impacts of proposed actions and to assist with planning mitigation and conservation.

Strategy: Develop a GIS system for mapping and updating quantity and condition of habitats within mule deer seasonal ranges, to serve as a basis for proposing management actions and habitat treatments designed to maintain deer populations.

What's been done:

- ✓ The Department has participated in developing several GIS systems including:
 - Decision Support System (DSS) to improve Wildlife Environmental Review analyses and comment preparation;
 - Remote sensing to delineate land cover types; and
 - Prototype GIS database and interactive, multi-agency system for tracking cumulative impacts.

- *Also, Wildlife Biologists continually evaluate and update seasonal range overlays.*

Objective: Avoid or minimize impacts to mule deer migration routes.

Strategy: Work closely with the Wyoming Department of Transportation, irrigation districts, railroads, energy companies, and other entities to design projects that minimize barriers to migrating mule deer and to incorporate features (e.g., over- and underpasses, ROW fences, project layout, etc.) that restore or improve migration over/through existing roads, highways, ditches, and other projects.

Strategy: Encourage the Wyoming Department of Transportation and county road departments to seed less palatable vegetation in highway rights-of-way to reduce vehicle/deer collisions.

Strategy: Recommend fence designs that are compatible with deer passage, and minimize entanglements.

Strategy: Continue to identify migration corridors throughout the state and assess risks to these migration routes, and develop solutions to potential conflicts.

What's been done:

- ✓ Department personnel have participated in numerous projects involving deer migration corridors and barriers;
- ✓ A statewide GIS database has been developed to map migration corridors and barriers, and is continually updated as additional information becomes available;
- ✓ The Department, in cooperation with the Wyoming Department of Transportation, has developed a statewide deer/vehicle collision database;
- ✓ Research on fence specifications, highway warning signs and detection systems, and under-passes has resulted in modifications to improve animal movement and reduce collisions;
- ✓ A habitat extension brochure on fence specifications was recently updated to incorporate results of recent research and field studies;
- ✓ The Department has developed wildlife-friendly fence specifications in cooperation with the BLM and Wyoming Department of Transportation.
- ✓ The Department, in partnership with industry and the University of Wyoming, has implemented or participated in research to evaluate migration corridors and recommend protective measures;
- ✓ The Department cooperated with the Wyoming Heritage Foundation of Wyoming and Wyoming Department of Transportation to modify fences to restore mule deer and pronghorn migration and to install a system to warn motorists of deer crossing Highway 191 near Pinedale.
- ✓ Finally, we have worked with various cooperators including land management agencies, private landowners and non-governmental organizations to identify and

protect important migration corridors such as Trappers' Point, routes across Anadarko Corporation's properties, and those circumnavigating Fremont Lake.

Objective: Maintain and improve programs and techniques to monitor the condition of deer habitats.

Strategy: Continue monitoring vegetation conditions in key deer habitats.

Strategy: Inform federal agencies when data indicate habitats are in poor condition. Encourage changes in habitat management to restore habitats in poor condition.

Strategy: Evaluate herd management objectives (i.e., population size) and, as appropriate, adjust them in balance with habitat condition and availability.

Strategy: Reevaluate all seasonal range delineations and, as appropriate, adjust them to reflect changes in deer distribution and habitat use.

Strategy: Establish vegetation transects to monitor important habitats in "key" herd units in each region. Data should include forage utilization measured in spring and productivity measured in fall.

Strategy: Work with land management agencies and private landowners to incorporate deer habitat monitoring in their programs.

What's been done:

- ✓ *The Wyoming Game and Fish Commission approved the Department's Strategic Habitat Plan in December 2001. Following the plan's guidance, the Department has identified priority wildlife habitats throughout the State.*
- ✓ *Each warden and biologist district has established vegetation transects to monitor key habitats.*
- ✓ *The Department has mapped all important mule deer habitats statewide.*
- ✓ *Wyoming Game and Fish personnel meet annually with BLM, USFS, NRCS, and other land management agencies to discuss habitat conditions, vegetation treatment projects, and recommend future management activities.*

Objective: Mitigate impacts of large-scale oil and gas developments. Field development and operations plans should include both onsite and offsite mitigation as appropriate to offset habitat losses and maintain mule deer populations.

Strategy: Use the Wyoming Game and Fish Commission's Mitigation Policy and the Department's "Recommendations for Development of Oil and Gas Resources within Crucial and Important Habitats" to develop mitigation plans for every oil/gas field impacting crucial mule deer habitats.

Strategy: Engage individual energy companies and appropriate state and federal agencies to develop and implement effective reclamation and mitigation strategies.

Strategy: Develop improved technological capabilities to mitigate energy development impacts.

What's been done:

- ✓ *The Department is actively working with industry, BLM, the Governor's Planning Office, and several interest groups to develop effective means of addressing energy impacts, including impacts that are likely to affect mule deer herds.*
- ✓ *The Department has created two permanent positions dedicated entirely to addressing energy-related impacts on wildlife. The Department is pursuing additional positions to better cope with these impacts.*
- ✓ *The Jonah In-fill Mitigation Trust Account, which supports one of the Department's energy mitigation positions, is among the first funding arrangements of its type in the nation and establishes a base for actions to accomplish needed mitigation.*
- ✓ *The Department coordinates closely with the BLM and USFS during the development and review of Resource Management Plans and Forest Management Plans, respectively.*
- ✓ *The Department is actively exploring ways to resolve conflicts between wildlife and energy development. We participated in an Oil/Gas Mitigation Workshop held in spring 2006 and have developed innovative solutions such as yearlong drilling from a smaller number of multiple-well pads, in order to reduce well pad densities and associated impacts in crucial wildlife habitat.*

Objective: Participate in large-scale mineral and energy development and mitigation planning efforts, including wind farms, to assure healthy mule deer populations and productive habitat conditions can be sustained.

Strategy: Become involved at the earliest possible stage in federal planning processes that relate to exploration and development of mineral and energy resources. Put together alternatives, including operational practices that least impact mule deer and their habitat (e.g., Best Management Practices) and develop mitigation plans to offset habitat losses and other impacts. Consult the Department's "recommendations for the development of oil and gas resources in crucial and important wildlife habitats: Version 2.0" and the Commission's Mitigation Policy.

Strategy: Encourage the BLM to withdraw important mule deer habitats from consideration for oil/gas leasing and other industrial developments.

Strategy: In cases where important mule deer habitats have already been leased, work with the BLM and leaseholder to minimize the footprint of disturbance

through directional drilling and other Best Management Practices which promote conservation of wildlife resources.

Strategy: Defer mineral leasing and development until appropriate technological capabilities for mitigation have been devised.

What's been done:

- ✓ *The Department has created two “Oil/Gas Development” positions that work directly with industry and Federal agencies to minimize impacts on wildlife. These positions have assisted in setting up formal studies to document impacts (e.g., studies are being done in the Baggs and Pinedale Mesa areas). More effective mitigation is also being implemented due to their efforts.*
- ✓ *Industry has acquired and provided to the Department specialized equipment (e.g., Lawson aerators and a tractor) needed for habitat improvements to mitigate development impacts.*
- ✓ *Industry has funded research to assess distribution shifts and survival of mule deer in the Pinedale Anticline and Baggs area oil and gas fields.*
- ✓ *The Department continues to diligently review each proposed lease and oil and gas development plan. The State of Wyoming is a “cooperating agency” in the Resource Management and Forest Management planning processes of the BLM and USFS, respectively. The Department serves its mission under this “cooperating agency” umbrella by recommending measures to maintain and improve habitat conditions for mule deer and other wildlife.*
- ✓ *The Department is a cooperating partner in the Wyoming Landscape Conservation Initiative, an interagency, interdisciplinary coordination team tasked with a long-term, science-based effort to assess and enhance habitats at a landscape scale in southwestern Wyoming.*

Objective: Manage recreational uses to reduce their impacts on mule deer and mule deer habitat.

Strategy: Protect crucial winter ranges and other key areas on Commission owned lands by seasonally closing the areas to ORV use and where necessary, to all human access. Encourage similar closures on Federal and state lands.

Strategy: Identify areas where ORVs or other types of recreation (snow machines, skiing, etc.) are impacting mule deer or their habitats.

Strategy: Work with federal agencies to develop travel management plans that include seasonal and permanent road closures and area closures, as needed, to protect crucial winter ranges and reduce excessive densities of open roads on transition and summer ranges. Encourage agencies to enforce their travel management plans.

What's been done:

- ✓ *The Wyoming Game and Fish Commission recently revised its regulations (Chapter 23) pertaining to public uses of Commission-owned lands. The regulations address travel and ORV management on Wildlife Habitat Management Areas.*
- ✓ *Travel restrictions on the Department's hunter management and walk-in access areas are specified by regulation.*
- ✓ *The Department, through a cooperative MOU with the Office of State Lands and Investments, has accepted responsibility for enforcing vehicle travel restrictions on State lands.*
- ✓ *Several educational articles about ORV ethics and impacts to wildlife have been printed in Wildlife News, Wyoming Wildlife Magazine, Department news releases, and other media.*
- ✓ *The Department considers its involvement with development and revision of travel management plans a high priority on Federal and State Lands.*

Objective: Limit the impacts of urban development and rural subdivision within mule deer habitat.

Strategy: Encourage land use planning statewide. Inform county and city planning and zoning boards where important mule deer habitats are located and encourage alternatives that avoid authorizing subdivisions and other developments within such areas and encourage zoning that protects open space.

Strategy: During project design and permitting, work closely with private landowners and developers to minimize impacts to mule deer.

Strategy: Identify key habitats most likely to be developed and attempt to protect them through conservation easements or other property interests.

Strategy: Continue to discourage artificial feeding by the public.

Strategy: Reduce mule deer vehicle collisions by recommending safety corridors, such as under-passes, in areas where busy highways and mule deer migration routes intersect. Review transportation plans to identify problem areas and recommend solutions.

What's been done:

- ✓ *The Department continues its involvement with city and county planning and zoning boards, encouraging them to include wildlife considerations in their plans. We have had exceptional success in Teton County.*
- ✓ *The Department cooperates with various land trusts such as The Nature Conservancy, Jackson Hole Land Trust, Star Valley Land Trust, and Upper Green*

- River Land Trust to set aside open spaces for wildlife including mule deer through conservation easements.*
- ✓ *We routinely submit comments and suggestions to city and county commissions during their public involvement processes. Many of our comments recommended considerations to protect and enhance mule deer habitats.*
 - ✓ *The Department has initiated Citizen Advisory Groups to address urban deer conflicts (e.g., the Garden Creek mule deer management plan).*

Objective: Prevent the introduction or expansion of invasive plants in mule deer habitat and promote control and reduction of infestations.

Strategy: Map areas where non-native invasive plants threaten mule deer habitat.

Strategy: Promote the aggressive treatment (using chemical, mechanical, biological, and grazing techniques) to eradicate non-native invasive plants.

Strategy: Conduct a “risk assessment” for invasion by invasive species in crucial mule deer habitats.

Strategy: Use multi- agency partnerships to develop coordinated approaches to identify and prioritize cheatgrass infestations and fund and implement control programs.

Strategy: Seek legislation to list cheatgrass as a noxious weed.

Strategy: Encourage the legislature, NGOs, and other federal agencies to promote and secure sufficient funding to manage and control invasive species and assist private landowners.

What’s been done:

- ✓ *The Department participates in a number of coordinated weed management groups.*
- ✓ *The Department applies for various integrated weed management practices on all Commission owned lands.*
- ✓ *The Department personnel have established a multi-agency group to address cheatgrass expansion in southeast Wyoming.*

Population Management

We manage populations of mule deer to maintain them within the capability of the habitat, provide recreational opportunity, and balance the diverse interests of stakeholders who include subsistence, recreational and trophy hunters, guides and outfitters, farmers and ranchers, conservation organizations, local businesses, federal land management agencies, urban and rural property owners, and the general public. Such groups often hold widely differing viewpoints and may not fully recognize the tradeoffs of alternative management philosophies. For these reasons, deer management can entail decisions that are socially and biologically complex. Although it is impossible to please everyone in every circumstance, the Department attempts to address the diverse expectations of Wyoming's citizens on a statewide basis.

Ultimately, the quality and condition of the habitat determines the maximum number of deer that can be sustained in a healthy herd. Some deer hunters believe present-day management should replicate the much higher deer densities they recall from the 1950s and 60s. However, that era coincided with a stage of vegetation health and vigor that was optimal for supporting highly productive mule deer populations. Looking back, many wildlife biologists believe mule deer were actually too abundant in the 1960s and that overabundance caused long-term damage to preferred forage plants. Since then, habitat conditions have continued to decline as a consequence of detrimental fire management (fire suppression and poorly designed prescribed burns), grazing practices, urban and industrial development, long-term drought, and in some cases, too many deer.

Chronically low fawn production, measured as the number of fawns per 100 does, is often the most immediate symptom indicating deer numbers may exceed what the habitat can support. Excessive deer densities can further damage the habitat base, resulting in a less productive herd that is susceptible to large-scale die-offs from disease and severe winters. On the other hand, maximum fawn productivity is achieved when the herd is held in check, well within the habitat's capability. Responsible management seeks to protect the habitat by maintaining stable, healthy deer populations. A productive deer herd in good habitat is also more resilient and capable of recovering sooner after severe climatic events.

The deer management program in Wyoming is based on a process called, "Management by Objective." Population objectives have been established for each deer herd in the State. Originally, the objectives were intended to be well within the carrying capacity of the habitat under normal climatic conditions. Objectives were also adjusted after input was received from sportsmen, landowners, and land management agencies. However, since the original objectives were set, unanticipated conditions such as long-term drought, large-scale developments, habitat fragmentation, competition with other ungulates, shrub reduction programs, fire suppression, and other intensive land management practices have reduced the carrying capacity of some deer herds. In light of these changes, some existing herd objectives may be set too high. In these circumstances, where possible, managers should

first focus efforts on identifying and then correcting the problem(s) before adjusting the population's objective to a lower level.

Hunting seasons are set to basically manage each mule deer herd within 10% of its population objective. When the population is outside this range, more liberal or conservative seasons are recommended, as needed, to reduce or increase the herd toward its objective. However, deer populations may be managed at a lower level to protect both the herd and its habitat when the carrying capacity is depressed as a consequence of protracted drought or other environmental factors. Conversely, some populations remain over objective due to inadequate harvest, predominantly where access to hunt is restricted. Sometimes, we lack adequate survey data to reliably estimate a deer population. In these cases, our harvest management may be based on alternative indicators such as hunter success or effort (days expended per deer harvested), or it may be based upon habitat measurements that detect whether a deer population is over-utilizing key forage plants.

The size of a deer herd is regulated primarily through harvest of female deer. In general, 6-12% of the does must be harvested each year to stabilize a moderately productive deer herd (e.g., 60-80 fawns per 100 does). Where deer numbers are out of balance with their habitat, it is important to harvest at least some does to maintain the herd at a sustainable level. Therefore, we may harvest 2-3% of the does even when a herd is below its population objective because this could protect the habitat during stressful environmental conditions such as drought. When habitat conditions improve, a 2-3% doe harvest will not prevent the population from recovering rapidly. On the other hand, failing to harvest at least some female deer when the population is below objective and the habitat is in poor condition may result in additional damage to the habitat and a more protracted recovery. In those instances where deer population growth is inhibited by other factors such as predation, doe harvest may not be needed or desirable.

The Department applies various harvest strategies depending on management needs. The most conservative strategy is a limited quota "bucks-only" season. This allows maximum population growth when habitat conditions are optimal. However, when habitat is in poor condition, a bucks-only season can actually do more harm than good by maintaining a higher deer density than the habitat is able to support. Either sex seasons achieve a limited harvest of does, but comparatively few hunters are willing to shoot a doe on a license that allows them to harvest a buck. A somewhat higher doe harvest can be realized by restricting an either sex license to does and fawns during the latter portion of the hunting season. Some hunters who were unsuccessful harvesting a buck at the beginning of the season will opt to harvest a doe later on. Another variation is to allow harvest of either sex at the beginning of the season, and then restrict the license to antlered deer only during the later segment. However, the Department has found that doe/fawn licenses are generally necessary when a significant number of female deer must be harvested. These licenses are always limited in quota, but are issued in sufficient numbers to achieve the necessary harvest of female deer.

Some hunters are opposed to harvesting does and continue to believe this practice is detrimental to deer management in Wyoming. As a result, the Department sometimes has difficulty harvesting enough does to meet population management objectives to protect the habitat base and avoid significant losses (i.e., “population crashes”). During the late 1980s, many herds in Wyoming increased dramatically during an “irruptive” growth phase, vastly outstripping the available habitats. Although the Department attempted to curb the undesirable population growth by harvesting additional does, efforts often met with resistance and were ultimately too little too late. After the winter of 1992/93 populations declined significantly, some by more than 50%. Doe harvest during the 1991 and 1992 hunting seasons was elevated to address deteriorating habitat conditions, but was not enough to cause the observed population declines. In fact, despite efforts to increase harvest and minimize over-winter mortality, observed mortality after the 1992/93 winter was significant in many areas. These declines happened primarily because deer were in poor body condition as there was simply too many of them trying to survive on already poor habitats. In many herds, long-term habitat degradation is evident from reduced fawn recruitment and elevated winter mortality. Many of these populations have not been able to sustain a recovery despite essentially no doe harvest since 1992. Where habitat is determined to be a limiting factor, it is important to harvest doe deer at all population levels to protect the habitat base thereby sustaining healthy deer herds.

Most deer herds in Wyoming are managed under a “recreational management” concept. Harvest is regulated to sustain between 20 and 29 bucks per 100 does measured after the hunting season has ended. In most areas, we are able to maintain buck:doe ratios within this range without limiting the numbers of hunting licenses available to resident hunters. These areas usually are open to hunting with a general license. “Recreational management” offers the maximum opportunity to hunt while providing a reasonably high quality experience for the majority of hunters. A smaller number of deer herds designated as “special management” are managed to sustain between 30 and 45 bucks per 100 does after the hunting season. In order to maintain these higher proportions of bucks, harvest pressure must often be reduced either by limiting the numbers of licenses (i.e., by setting limited quota seasons), or by setting very conservative hunting seasons under a general license framework. Herds that are managed to sustain a large percent of bucks do not produce as many deer to harvest because the proportion of does in the population is lower. Fewer does mean fewer fawns and ultimately, fewer deer to harvest. Consequently, hunting opportunity must be reduced both to lessen harvest pressure on bucks and to harvest a smaller surplus of deer. On the other hand, a deer population will produce the maximum number of deer for harvest when the buck:doe ratio is maintained between 20 and 29 per 100 and the total population is well within the carrying capacity of the habitat. Mature bucks are available in all deer herds in the state, regardless whether they are managed under “special” or “recreational management.” Based on management data, the proportions of mature bucks may be somewhat higher in special management herds.

Another harvest strategy sometimes employed to improve depressed buck:doe ratios is a “four-point or better” hunting season. It may seem counterintuitive, but antler point

restrictions do not necessarily produce more large bucks. In a 4-point or better season, the hunter is restricted to harvesting bucks with 4 points or more on either antler. Consequently, all harvest pressure is redirected to the largest deer in the population, which reduces their number. Since most yearlings and some 2-year old bucks are protected until they become small 4-point deer, the overall ratio of bucks to does will increase somewhat as a result of having more young bucks in the population. However, harvest is merely delayed until a buck grows its first set of 4-point antlers. The maximum benefit of a 4-point season is typically realized after the season has been in place 2 or 3 years, at which time most 4-point bucks are being harvested. Thereafter, the buck:doe ratio does not continue to increase and fewer bucks actually survive to grow truly large antlers. Over the long-term, persistently targeting large bucks may also eliminate desirable genetics (the ability to grow large antlers) from the population. If the objective is to produce more large deer, the 4-point restriction must be lifted after 2 years so harvest is once again spread over more age classes. This allows more of the incoming cohort of 4-point bucks to survive to an older age and potentially grow much larger antlers. Should the overall buck:doe ratio again decline to an unacceptably low level, the 4-point or better season can be reinstated for another 2-3 years to augment the number of bucks in the population, and the process is repeated. Permanent 4-point or better seasons do not produce more large bucks and actually reduce the harvestable surplus because some of the younger bucks that could have been harvested will die from other causes before they grow 4-point antlers. In addition, some small bucks are mistaken for legal bucks and are illegally killed and abandoned. Those deer represent a resource that is lost from the population and impact hunter opportunity in future years.

It is often difficult to gauge social preferences regarding deer management because at any given time, managers are more likely to hear from constituents who want some aspect of deer management changed, while those who are satisfied with the status quo tend to be less vocal in expressing their support. Some of the more common issues include: hunter densities; numbers of deer, numbers of bucks, or availability of large bucks; harvest success; hunting access; habitat conditions; and excessive use of off-road motorized vehicles. To objectively evaluate our constituents' viewpoints on these and other issues, the Department periodically conducts a survey of licensed deer hunters' attitudes and opinions toward deer management in Wyoming (Responsive Management 2006). The most recent survey sampled a random cross-section of resident and nonresident hunters who held deer licenses in 2005. Some of the key findings regarding social preferences in relation to mule deer management included:

- A majority of hunters (55%) felt the number of deer in Wyoming is about right, while 28% believed there are too few deer. *
- A strong majority of hunters (75%) agreed there were enough deer in their hunt area.
- A majority of hunters (68%) believed the number (density) of hunters was about right or could even be increased.
- The larger percent of hunters (49%) indicated the number of bucks was about right, while 41% believed there were too few bucks. *
- A majority of hunters (54%) believed the average size of bucks' antlers was about right, while 36% believed bucks were too small. *

- A large majority of resident hunters (73%) want the opportunity to hunt every year even if it means their success at harvesting a deer is lower.
- The majority of both resident (55%) and nonresident (54%) hunters prefer general deer hunting seasons. Lesser percentages (28% and 29% respectively) prefer limited quota hunting seasons. *
- Among the respondents who felt there were too many hunters in the field, the least popular option for reducing the number of hunters involved limiting hunting areas available to residents – only 34% favored this option.
- A significant number of resident deer hunters (39%) chose to hunt in more than one hunt area.
- A majority of hunters (68%) think the Wyoming Game and Fish Department is doing a good or excellent job of managing deer.
- Over 90% of those hunters who felt numbers of deer or numbers of bucks were too low, or average antler size was too small, indicated the best way to address these concerns would be through improving deer habitat.
- A solid majority of hunters (82%) support managing deer herds in balance with their habitat, even if that means reducing deer numbers or hunting opportunities.
- Large majorities of hunters (in each case, over 90%) believed it is important for the WGFD to manage the number of deer, the number of bucks, and quality of deer habitat in Wyoming.
- A majority of hunters (83%) feel it is important for the WGFD to manage motorized off-road vehicle use in deer hunt areas.

** The percentages do not total 100% in each case because a portion of the respondents expressed no opinion or no preference.*

On a statewide level, deer hunters in Wyoming appear satisfied with the existing management program and with existing conditions. Nevertheless, there are constituents, primarily in the western part of the state, who are dissatisfied with current management direction. Even where hunters are dissatisfied, there are differing opinions how mule deer should be managed, which further increases the complexity and challenge to meet the wide array of desires and expectations of hunters. In addition to the periodic statewide survey, local input is strongly considered in management decisions for individual herd units or hunt areas. There is (and always will be) some interest in reducing hunter densities, however the overall density of mule deer hunters has decreased by 51% due to attrition since 1980. There is also some interest in improving hunter success (overall success was 57% in 2005), and there is somewhat greater interest in increasing the availability of larger bucks. Although 53% of residents said they would support managing for larger bucks even if it meant more restrictions and reduced chance of hunting every year, this contradicts an even stronger desire to hunt every year and a preference for general hunting seasons. The approach the Department has taken is to maintain a diversity of management approaches that emphasize opportunity to hunt while providing, within reason, opportunities to hunt in special management areas and in limited quota seasons where harvest of mature bucks and high success rates are emphasized.

The following management objectives are vital to assure productive, resilient populations of mule deer and other wildlife are sustained over the long term.

Objective: Minimize the extent to which competing ungulates impact mule deer populations.

Strategy: Manage expanding elk populations within their established herd unit objectives.

Strategy: Improve our understanding of competitive interactions between mule deer and white-tailed deer, elk, pronghorn, wild horses, and domestic livestock. Develop management strategies to alleviate excessive competition and address conflicting wildlife management goals.

What's been done:

- ✓ *The Department continues to liberalize elk hunting throughout the state to decrease expanding elk populations by increasing license allocation, creating an additional cow/calf license sold at a reduced price, and extending hunting seasons in some areas as late as January 31.*
- ✓ *White-tailed deer management throughout the state is liberal and includes general license and/or limited quota license hunting in October and November.*
- ✓ *The Department funded two studies, conducted by the Wyoming Cooperative Wildlife Research Unit, examining competitive interactions between mule deer and white-tailed deer and between mule deer and elk. Final research reports were published in 1999 and 2000 and included:*

Sawyer, H. and F. Lindzey. 2000. Ecology of sympatric mule deer and white-tailed deer in riparian communities of Southeast Wyoming. WY Cooperative Fish and Wildlife Research Unit, University of Wyoming, Laramie. 49pp.

Porter, M.A. 1999. Spatial relationships of sympatric mule deer and elk in south-central Wyoming. M.S. Thesis. University of Wyoming, Laramie. 73pp.

Objective: Manage mule deer populations on a sustainable basis, within the carrying capacity of the habitat.

Strategy: Implement habitat improvement projects to increase habitat carrying capacity to sustain mule deer numbers at established population objectives.

Strategy: Where long-term habitat conditions are irreversible (i.e., due to permanent rangeland conversions, invasive plants, climate change, subdivisions, or large-scale energy development) and have been determined to cause mule deer population declines below established objectives, lower the objective to a sustainable level.

Strategy: Set hunting regulations to manage mule deer populations within the established herd unit objectives. Make further adjustments based on browse utilization readings and climatic conditions, to maintain herds within the existing capacity of the habitat.

Strategy: Monitor habitat conditions on key areas such as winter ranges and parturition (birthing) habitats.

Strategy: Periodically reevaluate herd unit objectives and adjust them as needed to assure the habitat is protected from overuse.

Strategy: Reduce mule deer populations when browse utilization readings on key shrub species exceeds 35% for three consecutive years.

What's been done:

- ✓ *In 2005, Wildlife Division personnel established permanent browse utilization transects in each region. Some regions had transects in place previously. These transects are read annually and considered in assessing habitat conditions and browse utilization by the existing ungulate population, and in setting mule deer seasons.*
- ✓ *In the mid-1990s, Casper region developed an index to assess habitat conditions and utilization in Bates Hole. Some of their transects are within mule deer winter range. The habitat use indices are calculated annually. Mule deer populations have been managed at lower levels to reduce browse utilization on key shrub species to less than 35%.*
- ✓ *Various strategies have been implemented to achieve harvest of female deer necessary to manage populations within herd objectives. These strategies include issuance of sufficient doe/fawn licenses, reduced license fees, allowance for hunters to obtain multiple doe/fawn licenses, and extended late antlerless deer seasons for full-price license holders.*
- ✓ *The Private Lands/Public Wildlife Initiative and various hunter assistance programs have improved access to private lands, helping us to achieve desired harvest levels.*
- ✓ *The Department has increased its emphasis on managing deer populations within herd objectives and within numbers the habitat can support on a sustainable basis.*
- ✓ *The Department has increased public information and education efforts through its season setting meetings and publications, impressing the need for managing deer populations within the habitat's capacity and the need to harvest female deer to accomplish this.*

Objective: Improve hunting opportunities in areas of difficult access to realize harvest levels needed to manage populations within objective levels and to maintain productive habitat conditions.

Strategy: Evaluate landowner attitudes regarding hunting seasons and access.

Strategy: Encourage federal land trades that consolidate public and private parcels, or provide access to landlocked public lands

Strategy: Increase public hunting opportunities through various landowner incentive programs, access easements, and additions/enlargements of Commission-owned lands and by improving habitat management on private, federal, and Commission-owned lands.

Strategy: Increase landowner confidence and contacts by working through Wyoming Conservation Districts and Department personnel to achieve better access and adequate harvest on private lands.

Strategy: Cooperate with the Wyoming State Land Board to facilitate hunting access on State lands and to enforce travel restrictions.

What's been done:

- ✓ *The Commission kicked off its “Private Lands/Public Wildlife” program (PLPW) in 2000. The program compensates private landowners for public access to hunt on private lands or landlocked public lands and is funded by voluntary contributions from sportsmen and from a portion of the Conservation Stamp revenue. Since the program began, tens of thousands of acres have been enrolled as “hunter management areas,” or “walk-in areas”.*
- ✓ *Several “hunter assistance” programs are operated in the state, usually by local Chambers of Commerce, to help hunters find a place to hunt. Some Department regional offices and game wardens also maintain lists of landowners who are willing to accept hunters.*
- ✓ *The Department has operated “hunter information check stations” in various locations. The program was begun during the early 1980s to assist hunters in the field. Department personnel manning the check stations answer a variety of questions including inquiries about places to hunt.*
- ✓ *The Commission owns and manages numerous habitat units, winter ranges, and access easements that are open to public hunting throughout the state. As opportunities arise, additional priority lands and easements may be acquired pending adequate funding.*
- ✓ *The Department’s regional offices periodically conduct surveys to assess landowner preferences regarding hunting seasons and hunter access. Game wardens and biologists frequently contact landowners to obtain their perspectives on these issues as well.*
- ✓ *The Legislature has included a “landowner coupon” on deer, elk, and pronghorn licenses to compensate landowners for wildlife use of private lands. The program was begun in 1939 and continues through the present.*

- ✓ *As the need arises, the Department issues additional hunting licenses to address depredation concerns on private lands. These licenses are almost always limited to doe/fawn deer and pronghorn or cow/calf elk only.*
- ✓ *The Department comments on all proposals to acquire, exchange, or dispose federal lands. We encourage acquisitions and exchanges that consolidate isolated parcels of federal lands and provide access to landlocked blocks of federal lands. We also support retaining accessible public lands, especially those containing important habitat, in federal ownership.*
- ✓ *The Department obtained a policy directive from the State Land Board in 1987, affirming the public's right to hunt and fish on all state lands under grazing leases. We also coordinated with the State Land Board to obtain clarification of rules pertaining to hunting and fishing access on state lands and recently (2006), a brochure on this topic was published. The brochure is being placed on the Department's public web site. In 2003, the Wyoming Legislature passed Enrolled Act 64, requiring the State to post signs on readily identifiable state lands that are legally accessible. The sign posting effort is currently underway.*

Objective: Provide diverse hunting opportunities to accommodate both the recreational and trophy mule deer hunter.

Strategy: Evaluate and consider results of deer hunter attitude surveys conducted at both the statewide and local levels to identify and implement hunting season frameworks and licensing systems that maintain or improve constituent satisfaction.

Strategy: Maintain general license hunting seasons while providing opportunities to hunt in areas that are managed to sustain a higher proportion of mature bucks or higher harvest success.

What's been done:

- ✓ *A Deer License Committee has been established to evaluate problems and benefits associated with issuing separate hunting licenses for mule deer and white-tailed deer, and with potentially converting all deer hunt areas to limited quota licenses only. A final report and recommendations are to be released in February, 2007.*

Objective: Identify and implement management actions to address depredation problems.

Strategy: Adjust hunting regulations to alleviate depredations caused by mule deer, while balancing desires of hunters and landowners.

Strategy: Implement strategies in addition to hunting to alleviate depredations.

What's been done:

- ✓ *Doe/fawn licenses are issued on a routine basis to alleviate depredation.*

- ✓ *In special circumstances and where justified, kill permits are issued to alleviate depredation.*
- ✓ *Special seasons (depredation seasons) are set to alleviate depredation within specific geographic areas.*
- ✓ *The Department supplies exclosure fencing free of charge to landowners experiencing depredation of haystacks by deer.*
- ✓ *The Department has available several extension bulletins to advise landowners and homeowners how to prevent or reduce depredation by deer. In addition, the Department provides technical assistance to landowners experiencing depredations.*
- ✓ *Since 1939, the Department has compensated landowners for damage to private property caused by big or trophy game when Department personnel can verify the damage and a claim is filed in accordance with state laws and Commission regulations.*
- ✓ *In 1999, The Department published the second edition of The Handbook of Wildlife Depredation Techniques:*

Buhler, M.L., S.H. Anderson, F.G. Lindzey, and T. Cleveland. 1999. The Handbook of Wildlife Depredation Techniques: 2nd Edition. WY Game and Fish Department, Cheyenne. 680pp.

Objective: Use appropriate survey techniques, within budgetary considerations, to monitor mule deer populations at a level of precision needed to assess results of harvest strategies, climatic or disease events, habitat treatments and other management or conservation actions.

Strategy: Evaluate monitoring and population census techniques utilized by other Western states. If alternative techniques merit consideration, identify two or three key herd units in Wyoming in which the techniques can be experimentally applied and the resulting data sets compared to data resulting from the Department's traditional survey techniques.

Strategy: Test Colorado's quadrat sampling method as an independent means of verifying population estimates in the Sublette Mule Deer Herd Unit.

Strategy: Identify an appropriate herd unit to test Montana's adaptive management strategy method as an independent means of verifying population estimates.

Strategy: Implement the most current, effective census techniques to assess mule deer population status. Standardize survey techniques statewide.

What's been done:

- ✓ *The Department's Mule Deer Working Group (MDWG) periodically reviews recent literature and contacts other state wildlife agencies to identify alternative techniques that may warrant consideration in Wyoming. Representatives from Colorado, Idaho, and Montana have attended MDWG meetings and given presentations on their states' monitoring and census procedures.*
- ✓ *Beginning in the mid 1990s, the Department began measuring fat deposition in field-checked deer to assess body condition and provide an indirect means of assessing habitat quality and availability.*
- ✓ *Beginning in 1994 the Department began conducting post hunting season change in ratio surveys and winter mortality surveys to gauge the impact of winter weather on deer populations in a few key deer herds.*

Strategy: Conduct annual herd composition surveys to assess population status after the hunting season has ended. Surveys should cover core winter range areas after the migration period and prior to onset of winter (November/December). A sufficient number of deer should be classified on the ground or from a helicopter to achieve statistically adequate sample sizes needed to reliably estimate age and sex ratios (i.e. buck:doe, fawn:doe ratios), and to provide a basis for estimating winter mortality.

What's been done:

- ✓ *Annual post-hunting season age/sex composition surveys are done in all herd units.*
- ✓ *The Department routinely field checks harvested deer and collects age/sex data.*

Strategy: Continue to use population modeling to estimate the size of mule deer populations based on herd composition surveys, harvest and non-harvest mortality, and natural overwinter mortality. Also consider alternative methods such as spreadsheet estimators, mark/recapture, sightability models, and quadrat sampling to determine whether management goals are being achieved.

What's been done:

- ✓ *The Department has relied upon POP-II to estimate deer population sizes since the early 1980s. Other methods are continually being reviewed and will be evaluated in selected herd units.*

Strategy: Continue running the big game harvest survey to estimate annual deer harvests, hunter success, and other statistics. Continue to estimate total harvest within $\pm 10\%$ at the herd unit level, with 90% confidence. Determine whether non-response is a significant bias affecting harvest estimates.

Strategy: Evaluate the potential for mandatory harvest reporting.

What's been done:

- ✓ *Biological Services and the harvest survey contractor refine and improve the harvest survey process on a continuing basis, in order to achieve the contractually-specified level of precision.*
- ✓ *A non-response bias study was completed in 2003 and 2005. Results were comparable to those of an earlier study conducted in the late 1970s. The amount of bias detected at the statewide level was nominal (generally less than a few percent).*

Strategy: Conduct post-winter mortality surveys and spring herd composition surveys to estimate fawn losses and age and sex proportions of the winter mortality estimates each year. Monitor winter survival of fawns and adults in key areas to maintain accurate indices of recruitment and survival.

What's been done:

- ✓ *Winter mortality surveys and/or spring classifications are done in key herd units throughout the state.*

Strategy: Obtain data from field-checked deer to monitor ages and gender of harvested deer, body condition, and geographic distribution of the harvest. Collect incisor teeth to accurately age deer based on laboratory analysis of cementum annular deposits.

What's been done:

- ✓ *For many years, the Department has collected incisors from harvested mule deer to estimate the age make-up of the harvest and to provide an unbiased estimate of the age structure of adult female deer in the population. However, tooth analyses have been curtailed in recent years due to budget constraints and because the data were redundant or were not used in many cases to make management decisions. Where such data are important to construct reliable population models, an adequate budget should be restored to collect tooth samples for laboratory aging.*
- ✓ *The Department routinely field checks harvested deer and collects age/sex data.*

Strategy: Assess the comparative importance of mule deer mortalities resulting from collisions with vehicles and trains. Assess whether these mortality sources may have a significant bearing on population management. Identify and implement mitigation practices to reduce the incidence of vehicles and trains colliding with mule deer, especially at important migration crossings.

What's been done:

- ✓ *The Department helped fund the Nugget Canyon Deer Study completed in 2003.*

- ✓ *Underpass structures, deterrent devices, and motorist warning systems have been installed at Nugget Canyon, the Pinedale area, and other key locations around the State.*
- ✓ *The Wyoming Highway Department maintains a deer collision database to identify problem locations along the State's highways.*
- ✓ *We have developed educational materials and signs that advise motorists about dangers of wildlife collisions and encourage safe driving practices when deer are present.*

Strategy: Continue to increase our knowledge of deer distribution, migration, and habitat use throughout Wyoming. Apply this information to manage deer more effectively, document potential impacts, justify the need for mitigation, and design more effective mitigation and habitat treatments.

What's been done:

- ✓ *For many years, the Department has mapped seasonal ranges utilized by mule deer throughout the State. The maps (geographic overlays) are often consulted to assess impacts of proposed developments. These maps have also been digitized and presently are available in a GIS format.*
- ✓ *The Department developed a Decision Support System (DSS) that became operational in 2005. The DSS is a geographic data system that includes distributional data, seasonal ranges, migration corridors and other critical information. The system was devised to assist Department personnel, companies and consultants with analyzing potential impacts of proposed developments and identifying mitigation opportunities.*
- ✓ *The Department has maintained a Wildlife Observation System (WOS) database since the late 1970s. This is the Department's longest standing, geo-referenced database containing seasonal distribution, herd composition, and mortality records for mule deer.*
- ✓ *In September, 2004 the Department compiled "Recommendations for Development of Oil and Gas Resources within Important and Crucial Wildlife Habitats." This document provides management and mitigation recommendations applicable to energy developments within important habitats of several wildlife species including mule deer. It is available on the Department's public web site. The document is currently undergoing revision to incorporate results of recent research.*

Objective: Continue to refine and improve the herd unit basis for managing populations of mule deer.

Strategy: Conduct studies of deer distribution and movements to refine seasonal range type delineations and herd unit boundaries. Revise herd unit boundaries and combine herd units as needed to meet the criterion of not more than 10% interchange between adjoining herd units.

Strategy: For those herds that we share with adjoining states, continue to improve coordination and data collection in order to attain better population and harvest estimates, and more reliable trend monitoring.

Strategy: Coordinate with wildlife agencies in neighboring states to cooperatively manage mule deer populations and to share management techniques and strategies.

What's been done:

- ✓ *The Department has and continues to conduct population movement studies where herd unit boundaries are questionable.*
- ✓ *The Department conducts surveys during critical periods to document habitat use and distribution.*
- ✓ *The Department has made several attempts to coordinate data collection with adjoining states.*
- ✓ *The Department entered into a “good neighbor” agreement to cooperatively manage interstate wildlife populations (Memorandum of Agreement on the Management of the Multi-state Wildlife Resources in Boundary Habitats of Colorado, Idaho, Montana, Utah and Wyoming).*

Predator Management

Many predators such as coyotes, mountain lions, wolves, bobcats, black bears, and eagles prey on mule deer. Ballard et al. (2001) provided a review and synthesis of research on deer-predator relationships, which formed the basis for the chapter on deer-predator relationships in “Mule Deer Conservation: Issues and Management Strategies” (deVos et al. 2003), and the context for the discussion on predation in the “North American Mule Deer Conservation Plan” (Mule Deer Working Group 2004). We borrowed heavily from these documents in writing the Predation section of the Wyoming Mule Deer Initiative.

Relationships between predator and prey populations, habitat variables, and weather events are dynamic and complex. The extent to which predators affect mule deer populations seems to vary with the circumstances surrounding each deer herd at any particular time and can also vary year to year, depending to a great extent on the size of a mule deer population in relation to the habitat’s carrying capacity. This relationship is impacted by variables such as changes in habitat quality and quantity, weather patterns (prolonged drought or severe winters), competition with other ungulates for forage, species and densities of predators, effects of deer harvest strategies, and abundance of alternate prey. Managers must consider all of these factors in determining whether predator management is appropriate, and if so, in prescribing effective predator management.

Predator management may or may not increase the size of a mule deer population. For example, a mule deer population near the habitat’s carrying capacity will not respond, in a sustainable manner, to predator management. Habitat carrying capacity is difficult to determine and varies from season to season and year to year. However, several indices may indirectly indicate carrying capacity has been exceeded. For example, adults in poor body condition, low birth rates, low fawn:doe ratios, high utilization of available forage, and high deer population densities all suggest a deer population has surpassed the capacity of the habitat to support a growing deer herd. In this circumstance, predator management to decrease mule deer predation may not be desirable or effective.

On the other hand, a mule deer population that is chronically depressed while maintaining good fawn production and adult deer body condition but low fawn recruitment and adult survival in otherwise favorable habitats (i.e., a “predator pit”) may respond to predator management (Cougar Management Guidelines Working Group, 2005) especially if control actions target the predator(s) that is limiting the population. Further, Hurley and Zager (2005) demonstrated decreasing mountain lion predation in Idaho increased adult doe survival and allowed for a slight deer population increase. They also showed a decrease in the number of coyotes resulted in increased fawn survival through summer, but that this did not increase fawn recruitment into the population. A reduction of predator populations may be warranted given the specific circumstances and management goals for each individual herd unit.

The Wyoming Animal Damage Management Program was created by the Wyoming Legislature in 1999 and is administered by a 15 member board, commonly referred to as the Animal Damage Management Board (ADMB). The ADMB was established for the purpose of mitigating damage caused to livestock, wildlife and crops by predatory animals, predacious birds and depredating animals or for the protection of human health and safety. In addition, the ADMB administers funds available to Qualifying Predator Management Districts from each county in Wyoming to implement predator management strategies in accordance with the ADMB's mission. The intent of these programs is to benefit mule deer and other wildlife. Since this is a new program, it is unclear whether their efforts will achieve desired results.

It has been shown predator management may be beneficial to mule deer when:

1. The mule deer population is well below the habitat's carrying capacity;
2. Populations of alternate prey species (for example rodents and rabbits) are at low levels;
3. Predation has been identified as a factor limiting growth of a mule deer population;
4. The management action targets the predator actually limiting the population;
5. Management efforts can reduce predator populations enough to yield results;
6. Predator management is conducted at a time of year when it is most effective;
7. Predator management is focused in small areas of habitat critical to mule deer;
8. Management efforts are sustained over a period of years to keep the predator population sufficiently in check; and
9. Any increase in the deer population can be removed by harvest to increase hunting opportunity.

The Wyoming Game and Fish Commission adopted a policy in 2006 to direct Department involvement in ADMB and Predator Management District coyote control projects. Many of the strategies outlined below reflect that policy but are intended to address all predatory animals and trophy game animals (i.e., mountain lions) that predate on mule deer.

Objective: Develop and implement predator management plans that are both ecologically sound and consistent with management objectives for mule deer herds.

Strategy: Predator management intended to increase mule deer recruitment and survival should be considered only if habitat conditions are sufficient to support an increase in the mule deer population. If habitat conditions cannot support larger mule deer numbers, any added recruitment needs to be removed annually through more liberal hunting seasons.

Strategy: Predator management is not recommended to support additional growth of any mule deer herd unit that is over the Commission approved population objective, or to benefit the species on the hunt area level in any hunt area that is over the desired population level for the hunt area.

Recommended Action: Predator management is not recommended if it is targeted to increase mule deer in those portions of individual hunt areas with chronic damage caused by mule deer.

Objective: Assess the effectiveness of predator management practices and determine trigger points that would cause initiation and termination of predator management programs.

Strategy: Evaluate the effectiveness of the lethal take of predators as a management tool to increase mule deer recruitment and/or survival, when post hunting season (November/December) fawn:doe ratios are less than 65:100, or after sudden population losses (winter die-off) greater than 25%.

Strategy: Evaluate the effectiveness of predator management when mule deer productivity and fawn survival data are not available, the population is more than 15% below its objective level, and the population is below carrying capacity.

Objective: Maintain a dialogue and ongoing exchange of information between the Department, the ADMB, county Predator Management Districts, and various segments of the public with regard to predator management issues.

Strategy: Disseminate information through public forums, reports, research findings, and peer-reviewed publications to explain the Department's actions and predator management strategies directed at improving mule deer populations;

Strategy: Clearly communicate the Commission's rationale for its Policy on Predatory Animal and Predacious Bird Management Recommendations for the Benefit of Wildlife.

Objective: Identify gaps in our understanding of the interactions between mule deer and various predators. Recommend research needed to answer questions related to this issue.

Strategy: Conduct research to determine if predators are limiting mule deer populations under differing environmental conditions. This research should consider herds with a range of vital rates (i.e., fawn recruitment and mortality rates), in various habitat types, to determine if predator control is an appropriate and effective management action.

Objective: Implement predator management to maintain or increase mule deer populations when predation is determined the cause of a population decline or is suppressing population recovery from a decline.

Strategy: In herds that are below carrying capacity, identify important parturition areas where mule deer bear their fawns. Annually direct Wildlife Services and county Predator Management Districts to focus coyote control actions within these areas from February through July.

Strategy: If herds are below the objective and the habitat's carrying capacity and it is believed predation is limiting population growth (i.e., fawn production and adult deer body condition are good but fawn recruitment and adult survival is low suggesting a "predator pit"), reduce predator populations through liberalized hunting.

What's been done:

- ✓ *The Wyoming Game and Fish Commission contributes \$100,000 annually to the Animal Damage Management Board for predator control in areas where predation is thought to limit the size of desired wildlife populations. In recent years coyote control, primarily through aerial gunning, denning, and trapping, has been undertaken in areas of especially low fawn recruitment. As a general rule, habitat conditions rather than predation limit fawn survival. In light of this reality, in order to most effectively utilize the limited funding that is available, the Department has not undertaken widespread predator control. Instead, control has been limited to local areas where some action might be necessary and effective.*
- ✓ *Through legislative appropriation to the ADMB, money has been made available to qualifying predator management districts for the purpose of addressing predatory animal impacts to wildlife including mule deer. The Department will be communicating and coordinating with the ADMB and predator management districts to guide their predator management efforts to maximize benefits for mule deer.*
- ✓ *Mountain lion management has been driven by public perceptions and increases in lion densities throughout most of the State. Lion mortality quotas have been liberalized in most hunt areas over the past 10 years. One justification is the concern lions are adversely impacting popular prey species, primarily mule deer. In most situations it is unclear if the higher lion harvests have actually decreased predation on mule deer or whether deer populations have responded. However, most lion management units have either stable or increasing populations of lions, so it is unlikely that mule deer populations would have responded even though there has been increased harvest. It will take increased surveillance, and possibly detailed studies, to understand the relationship between mountain lion harvest and deer population response.*

Diseases

Diseases and parasites play an essential role in the ecology of all wildlife populations and have been a normal part of the life cycle of mule deer for as long as mule deer have existed. Diseases are among the environmental factors that naturally regulate deer populations. The ultimate effect a disease or parasite has on a population depends on a variety of conditions related to the host organism (deer), the specific pathogen, and other environmental factors. Factors related to the host can include the density and age structure of the population, general health or physical condition of animals in the population, degree of interchange between herds, and whether the animals have been previously exposed to the disease (animals that survived a prior outbreak often develop a degree of immunity). Pathogen factors include the specific type of disease, mode of transmission, virulence, and whether the pathogen is new to a population or enzootic (always present at some level). Important environmental factors can include the condition of the range or forage, other nutritional parameters, distribution of water sources, and stressors such as drought, extreme cold, or heavy snow.

In general, most diseases of mule deer are believed to have little effect at the population level. However, the consequences of disease are difficult to study because sick deer are not easily found unless they die in large numbers or in areas where the carcasses are easily observed. Sick animals tend to seek seclusion, are more prone to predation, they are eaten by scavengers, or decompose soon after they die. Managers and researchers typically locate only a few individuals during a die-off, and in most cases only large die-offs are studied. Rigorous studies of diseases, based on statistically adequate samples, are difficult to undertake and cannot be done within current agency budgets. Another problem is that clinical signs of many diseases are often similar and make field diagnosis challenging. In most cases a veterinary laboratory is several hours away, so it can also be difficult to obtain clinical diagnoses by properly trained personnel. Some of the more important diseases affecting mule deer populations in Wyoming are described.

Epizootic hemorrhagic disease (EHD) and bluetongue are closely related diseases which can have population limiting effects locally or regionally in Wyoming and elsewhere in the western United States. The viruses causing the two diseases are transmitted by the same biting midges. The two diseases produce indistinguishable symptoms in deer and pronghorn. Outbreaks typically happen in late summer or early fall and are most severe during wet years, especially when the first frost is delayed. This enables the biting gnats that spread the diseases to become more prevalent and live later into the fall. The diseases have two forms. The acute form kills or sickens large numbers of deer over a comparatively short period of time. Symptoms include edema (swollen tissues) and hemorrhages throughout the body. Infected deer are commonly found sick or dead at water sources, often exhibiting respiratory distress, excess salivation or drooling, loss of awareness of their surroundings, and sometimes swollen tongues or eyelids. The chronic form does not result in large-scale die-offs; however, emaciated deer are found (or sometimes shot during hunting season) with lesions in their mouths, rumen, and on their hoofs. A confirmed diagnosis requires laboratory analysis of tissue samples to identify the virus.

Chronic wasting disease (CWD) is caused by a protein particle called a prion, which can transform normal proteins into an abnormal form. All members of the deer family (mule deer, white-tailed deer, elk, and moose) are susceptible, although to this point in time, the disease has been most prevalent in mule deer and white-tailed deer. CWD affects the central nervous system, eventually leading to abnormal behavior, weight loss or emaciation, excessive salivation, droopy ears, a scruffy looking hide, and ultimately death. As with hemorrhagic disease, deer showing these symptoms are often found near water sources and are usually unaware of their surroundings or the approach of humans. A useful way to distinguish CWD from hemorrhagic disease is based on the nutritional status of the animal – deer with CWD are usually thin or emaciated, whereas deer affected by acute hemorrhagic disease generally are in good nutritional condition. Chronic wasting disease has been present in southeast Wyoming for at least three decades and continues to spread into other regions, albeit fairly slowly.

Pasteurellosis is a comparatively rare bacterial disease known to infect mule deer in Wyoming. The disease can cause various symptoms including pneumonia, hemorrhagic septicemia, arthritis, meningitis, and mastitis. Onset is often rapid and infected animals usually die after a short time. The pneumonia form is most prevalent in wild deer.

Pink-eye, (keratoconjunctivitis) is an inflammation of the conjunctiva and cornea of one or both eyes. Symptoms include reddened, swollen eyes or eyelids, often with mucoid or pus-like discharge, and sometimes cloudiness of the cornea. Pink-eye is fairly common, often recurs in the same locations winter after winter, and can be caused by numerous different bacteria and viruses. This disease tends to be more prevalent in denser deer populations and there is some speculation the disease is spread when deer concentrate at feed sites. One potential cause of pink-eye that warrants special mention is plague or infection with the bacterium *Yersinia pestis*. Several cases of pink-eye have been associated with plague-infested areas over the past several years. In most of these cases the deer also had plague bacteria in other tissues (lung, liver, and lymph nodes) and were found very ill or dead. This type of pink-eye poses serious risks to human health, and appropriate precautions should be taken to prevent transmission from sick or dead deer to humans. The impact of pink-eye at the population level is unknown, but several cases of multiple deer mortalities resulting from pink-eye infections have been documented over the past decade, in various locations around the state.

Deer adenovirus is an emerging disease in Wyoming. This disease has been diagnosed in moose in Canada and Wyoming, mule deer in Oregon, Washington, California, and Wyoming, and white-tailed deer in Idaho and Iowa. Adenovirus was the cause of a hemorrhagic disease that caused high mortality in mule deer in central and northern California in 1993 and 1994. It is estimated over a thousand deer died during this outbreak. Infected animals develop systemic disease resulting in swelling and/or fluid accumulation in the lungs, bloody diarrhea, and/or localized infection with lesions in the mouth and rumen.

Currently, the Department is conducting research to evaluate the effects of adenovirus in mule deer and white-tailed deer.

Among the diseases affecting mule deer in Wyoming, CWD is presently our greatest concern. On the other hand, mule deer co-evolved with many endemic diseases that for the most part are not considered a substantial threat at the population level. From a management perspective, the risk of importing new diseases has much more serious implications. As game ranching, private ownership, transportation and trade of wildlife continue to increase around the world, new and emerging diseases will potentially pose significant jeopardy to mule deer and other wildlife. Although feeding deer seems benign, it artificially concentrates animals and increases the risk of disease transmission and can be a significant and widespread form of disease transmission. Equally, it is very important to maintain and enforce current regulations controlling the transportation and importation of deer and elk carcasses to reduce the risk of disease transmission to new areas. Our priorities should include effective monitoring and surveillance, research on the distribution, transmission and effects of known diseases, and control and prevention of spread of new diseases. A major goal of wildlife agencies is to assure diseases and parasites do not unnaturally limit mule deer populations.

Objective: Monitor the distribution and effects of known diseases affecting mule deer (i.e., CWD, EHD).

Strategy: Continue to monitor and manage CWD in accordance with the Department's CWD plan.

What's been done:

- ✓ *The Department sampled and tested over 17,000 hunter-harvested deer, 301 targeted surveillance deer, and an unknown number of road-killed deer from 1997 to 2006.*
- ✓ *The Department maintains a GIS database depicting the distribution and prevalence of CWD positive deer.*
- ✓ *The Department has been or is involved in research projects on chronic wasting disease to:*
 - *Estimate whether CWD affects white-tailed deer use of various habitats and as a result their interaction with cattle.*
 - *Determine how the infectious agent of chronic wasting disease may be transmitted among mule deer and elk. Currently, several samples, such as feces, urine, blood, and saliva, are collected from infected elk held in metabolic cages. These biological samples are analyzed at the University Of Wyoming for the presence of CWD.*
 - *Develop a CWD tissue bank where CWD-infected mule deer, white-tailed deer, and elk are euthanized periodically and multiple tissues harvested. These tissues will be distributed worldwide to other researchers who are conducting a variety of projects concerning chronic wasting disease.*

- *Model the effects of long-term exposure to chronic wasting disease on a captive population of elk. These elk are exposed to the CWD infectious agent, both from other infected elk and through the environment. The purpose of this study is to determine how long elk will survive in the face of maximum exposure to chronic wasting disease. From this longevity, a model can be developed, incorporating reproduction and other mortality factors, to estimate the effects of chronic wasting disease on a free-ranging population of elk.*

Strategy: Continue routine monitoring of other diseases and parasites, collect specimens and samples for analysis.

What's been done:

- ✓ *The Department routinely collects tissue samples from deer that appear sick or are suspected to have died from disease in all areas of the state. Samples are sent to the Veterinary lab for analysis.*

Strategy: Adjust hunting seasons, as appropriate, in response to large-scale disease outbreaks and die-offs.

What's been done:

- ✓ *When the Department becomes aware of large-scale mortality events, we consider adjusting hunting frameworks in order to account for the loss of animals to disease and other factors. In rare instances, we may also consider public health issues.*

Strategy: Provide training to assist field personnel with detecting and identifying diseases and parasites, and with surveillance, monitoring, management, necropsy and tissue sampling procedures.

What's been done:

- ✓ *The Department provides appropriate training to personnel when specific needs arise to monitor diseases. For example, we conduct workshops each year to train personnel how to collect and handle tissue samples for CWD testing. We have also provided training on Brucellosis and EHD surveillance and testing.*
- ✓ *The Department published a book addressing the identification and pathology of wildlife diseases in Wyoming:*
Thorne, E.T., N. Kingston, W.R. Jolley, and R.C. Bergstrom (eds). 1982. Diseases of Wildlife in Wyoming. Wyoming Game and Fish Department, Cheyenne. 353pp.
- ✓ *The Department has also provided personnel copies of the following publication:*
Friend, M., J. Christian, and E.A. Ciganovich (eds). 1999. Field Manual of Wildlife Diseases. U.S. Geological Survey Information and Technology Report 1999-001. Washington, D.C. 426pp.

Objective: Reduce the risk and incidence of non-endemic parasites and diseases.

Strategy: Regulate the import, export, and transportation of deer and elk carcasses from known CWD areas.

What's been done:

- ✓ *The Department has developed and the Commission implemented regulations to restrict transportation of big game carcasses within and from known CWD areas.*

Strategy: Regulate wildlife transportation and prohibit game ranching

What's been done:

- ✓ *Transportation and possession of wildlife are regulated under Chapter 10 of the Wyoming Game and Fish Commission's regulations.*
- ✓ *Private ownership of big game has been prohibited in Wyoming since 1973. Game ranching is also prohibited. The Department will steadfastly discourage efforts to legalize game ranching because this commercial activity poses very serious and irretrievable risks to the State's native wildlife. Elsewhere, game ranching has had devastating impacts as a consequence of disease, hybridization, and competition with escaped nonnative species.*

Strategy: Discourage feeding of mule deer.

What's been done:

- ✓ *The Department has published several popular articles and press releases educating the public about problems created by feeding big game. These articles are periodically re-released. It is also no longer legal to hunt big game over baited areas.*

Strategy: Manage mule deer populations at healthy levels that can be supported by existing habitat conditions.

What's been done:

- ✓ *The Department attempts to manage mule deer herds within established population objectives. The objectives account for the habitat's carrying capacity and are adjusted when necessary.*

Law Enforcement

Wildlife laws and regulations serve three broad purposes: 1) protect the resource; 2) protect the public; and 3) assure equitable opportunity to enjoy the resource. A strong majority of the hunting and non-hunting publics support effective wildlife laws that are firmly and fairly enforced. Due to the rapid evolution of outdoor technology, increasing numbers of users, and increasing trophy values, wildlife law enforcement remains as important today as it was during the early years of the conservation movement.

Several important functions of law enforcement include:

- 1) Regulate off-road vehicle (ORV) use and recreational activity on crucial winter range. Mule deer are negatively impacted by heavy off-road vehicle use and high levels of dispersed recreation on winter ranges. Impacts can include displacement of mule deer from preferred habitats, resource damage, and illegal access to Wilderness Areas or areas seasonally closed to recreational activity to protect wildlife and other resources. Many hunters concerned about the problems ORV abuse cause are increasingly urging the Department to establish and enforce ORV travel restrictions during deer seasons.
- 2) Detect and reduce illegal harvest or poaching of deer – Mule deer are especially vulnerable during the rut and in winter when they congregate on traditional wintering areas. While poaching impacts both does and bucks across all age classes, most illegal hunting targets mature bucks removing genetically superior animals from the population. This loss can impact the quality of bucks in future generations of deer. Significant poaching activity reduces population size, potential fawn productivity, and the number and quality of bucks that can be harvested by law-abiding sportsmen in subsequent years.
- 3) Maintain an effective system of deer management – Perhaps the most important role of law enforcement is to secure our ability to regulate harvest within prescribed, biological limits. The institution of law enforcement and its field presence assure the majority of hunters comply with statutes and regulations designed to manage harvests within sustainable levels.
- 4) Enhance public support and recognition of wildlife laws – Support for the Department originates at the local level. Through contacts and presence in local communities, enforcement personnel foster greater understanding of wildlife laws and public support in enforcing them.

Objective: Increase compliance with wildlife laws designed to protect mule deer populations and habitats.

Strategy: Set compliance goals pertaining to travel management and State Land off-road travel statutes.

What's been done:

- ✓ *On Commission owned lands, travel management programs have been implemented to minimize disturbances to mule deer.*
- ✓ *On some Forest Service and BLM lands, the Department has entered cooperative agreements closing important winter ranges to human and vehicular access.*
- ✓ *Through periodic consultation and coordination, the Department encourages the USFS and BLM to implement travel management plans and increase enforcement of existing travel restrictions on public lands.*
- ✓ *The Department has entered into a memorandum of understanding with the State Land Board, enabling the Department to enforce illegal off-road travel, camping, and fires on State Land Board Trust lands.*

Strategy: Implement programs to protect mule deer when they are most vulnerable to harassment and illegal take, especially on winter ranges.

What's been done:

- ✓ *The Department has implemented travel and access management plans, road closures, winter range closures, and motorized travel limitations on Commission owned lands. We encourage federal agencies to institute similar closures and restrictions within important habitats on federal lands to protect mule deer during critical times of year.*
- ✓ *The **Stop Poaching** program is a joint effort between the Department and the Wyoming Wildlife Protectors' Association. The program pays a reward to persons who report information leading to the arrest and conviction of wildlife violators. The **Stop Poaching** enhancement program procures billboards, hats, knives, bumper stickers and brochures used to inform the public. A **Stop Poaching** slide show is presented at hunter safety classes to illustrate the cost of ignoring poaching activities. "Poaching Stories" is a sought after publication depicting true life accounts from the files of game wardens and wildlife investigators statewide. The series, based on investigations and prosecutions of resource abusers, encourages the public to support wildlife law enforcement and assist the Department through the **Stop Poaching** program.*
- ✓ *The Department developed a computerized licensing system to more easily detect license fraud. This system is used frequently within Wyoming and is shared with investigators from other states.*

Strategy: Emphasize operations to apprehend poachers and continue to develop more sophisticated enforcement technologies.

What's been done:

- ✓ *The Department utilizes task forces to detect poaching activities. Officers from warden districts around the state are assembled to serve on these task forces. Although catching violators often requires substantial time in the field, the public strongly supports these types of operations because they resolve high profile cases involving illegal take of trophy mule deer. Perhaps the greatest benefit is the publicity value, which serves as a strong deterrent to others who may contemplate similar crimes.*
- ✓ *The Wyoming Game and Fish Laboratory at the University of Wyoming analyzes forensic evidence such as hair, blood, bone, feathers, meat, tracks, saw marks, ballistics, or photographs. This essential service assists the Department in resolving many wildlife crimes each year. One noteworthy development in recent years is the use of DNA evidence to link the perpetrator to a crime scene. Wildlife forensic science pioneered the application of DNA technology for this purpose.*

Strategy: Increase contacts with the public, prosecutors, judges, and legislators to build support for adequate fines and penalties and stronger laws to provide an effective deterrent.

What's been done:

- ✓ *The Wyoming legislature promulgated a law commonly known as the “winter range statute,” which substantially stiffened the penalties for illegal take of antlered or horned big game animals without a proper license or during a closed season. Those found in violation may be fined up to \$10,000, imprisoned up to one year, or both.*
- ✓ *A forfeiture statute was also promulgated enabling the court to seize devices and equipment including firearms, ammunition, traps, snares, vessels, motorized vehicles, and aircraft used to aid in the illegal take of wildlife under the winter range statute.*
- ✓ *Wyoming statutes grant the Wyoming Game and Fish Commission authority to establish by rule and regulation restitution values of wildlife, which the courts consider in assessing fines and penalties. The restitution value of mule deer is currently \$4,000.*
- ✓ *The legislature promulgated a statute allowing wildlife officers to deploy decoys that simulate wildlife and to charge persons who attempt to take simulated wildlife in violation of game and fish laws. Mule deer decoys are frequently used in “sting” operations to detect violations such as shooting from a road, hunting without the proper license, hunting in the wrong area, and so forth.*
- ✓ *Wyoming, along with 24 other states, is a member of the Wildlife Violator Compact. States that are signatory to the compact recognize and enforce court-ordered revocations of hunting, fishing and trapping privileges regardless which member state prosecuted the violation(s).*

Strategy: Maintain a sufficient enforcement presence to attain a high level of compliance with wildlife laws and to deter illegal activity.

What's been done:

- ✓ *The Department created a Wildlife Investigative Unit in 1996. These officers primarily focus on complex and long-term investigations. They assist regional wardens by taking on more time-consuming, in-depth investigations necessary to successfully prosecute cases involving multiple offenders, illegal commercial activities, multiple jurisdictions, and other similar types of cases.*
- ✓ *Investigative unit coordinates with USFWS to address interstate movement of illegally taken mule deer.*

Weather

Weather events and long-term climatic trends can affect mule deer directly and indirectly. During severe winters, deep or crusted snow restricts deer movements and access to forage. Exceptionally cold weather also increases metabolic stress. These conditions can exhaust fat reserves, leading to malnutrition and higher mortality. Fawns are especially vulnerable to high mortality rates in winter and adults can be susceptible when they are in poor condition. In addition, fawn production is often lower the spring following a severe winter because some does may reabsorb their fetuses in order to survive, or they give birth to fawns in poor condition. The Wyoming Game and Fish Department recognizes some winters are so severe that significant mortality of mule deer will occur. The Department developed criteria for managers to use when evaluating whether or not to implement a feeding program (Appendix 1).

Seasonal precipitation patterns strongly influence the quantity and quality of forage available to deer, which in turn affects the overall health and productivity of a herd. During years of favorable moisture, plant growth, the availability of preferred plants, and nutritional content of forage improve. Deer are able to recover more quickly from the prior winter and accumulate ample fat reserves through the summer and fall. Deer in good quality habitat typically have higher reproductive and survival rates, and grow more quickly. Does tend to bear twins and produce sufficient milk to raise healthy fawns that are less susceptible to predation and disease. Fawns that grow to a larger size by fall also have a better chance of surviving their first winter.

Mule deer have adapted to a variety of environments ranging from low to high elevations, southerly to northerly latitudes, native rangelands and forests, and regions heavily modified by land use changes. The effects of weather and climate can vary markedly among these environments. For example, drought tends to have a more pronounced impact on mule deer inhabiting rangelands and agricultural regions at lower elevations. On the other hand, severe winters can be a more significant factor in mountainous environments where deer have dependable access to succulent forage in the summer, but are exposed to harsher winter conditions.

We have an incomplete understanding of how mule deer populations are affected by complex interactions among weather and other environmental factors. The number of deer that die during winter can be influenced by the nutritional condition of the deer in the fall, the sequence and timing of winter storms, depth and duration of snow cover, crust formation, duration of cold temperatures, and quality of forage on winter ranges. Combinations of these environmental conditions can modify the effect of weather. For example, deer in good nutritional status at the beginning of the winter can withstand more severe conditions, whereas deer in poor health during a drought may succumb in even a mild or normal winter. It is important to develop a better understanding of weather-related effects to improve how we manage deer and their habitat.

Global climate change is a more recent phenomenon that may have long-term effects on mule deer (deVos and McKinney 2007). Warmer temperatures may result in plant and animal species ranges shifting northward, reduced plant vigor and productivity, plant community composition changes and increases in invasive exotic plants. These factors could affect deer distribution, density and productivity in Wyoming. Managing Wyoming's deer herds at levels compatible with habitat that is less productive and more limited in availability will require managing populations at lower levels.

Objective: Improve methods used to estimate winter mortality of deer and implement management practices to moderate the adverse effects of weather.

Strategy: Analyze available data on climatic trends within mule deer ranges.

Strategy: Study the relationships among seasonal precipitation, availability and quality of forage, and trends of mule deer populations.

What's been done:

- ✓ *The Department developed Weather Severity Indices (WSIs), based on precipitation and temperature data, to predict the effects of weather on fawn production and deer survival. Although the indices seem to have limited utility on a finer scale, they may have some value as anecdotal information to verify effects of extremely harsh weather.*
- ✓ *The Department conducts mortality surveys each spring to document the magnitude of loss and the age and sex composition of animals that died over the winter.*

Strategy: Reduce the potential for severe weather to impact mule deer populations by maintaining deer herds within the habitat's carrying capacity and maintaining (or improving) habitats in optimal condition.

What's been done:

- ✓ *The Department has implemented numerous habitat treatments and improvement projects, which enable deer to cope better with weather extremes.*
- ✓ *The Department manages deer populations within established objectives to protect the condition of the habitat, which in turn helps to moderate the impact of unfavorable weather patterns.*

Strategy: When winter conditions and predicted deer winter mortality are severe, evaluate the criteria and logistics necessary outlined in Appendix 1 to most effectively and efficiently implement a winter-feeding program.

Elk and Deer Interactions

Mule deer and elk potentially compete for certain resources where ranges of the two species overlap. Although elk are predominantly grazers (eating grasses and forbs), and mule deer are predominantly browsers (eating shrub leaves, stems and buds), diets of the two species change seasonally and at times, they may compete directly for the same food. For example, newly growing forbs and grasses are important to both elk and mule deer in spring and early summer, and elk will consume a variety of shrubs and willows also eaten by mule deer in winter. In addition, the two species may compete for space at certain times of year. The degree of competition and its impact continue to be debated among biologists. Several aspects of this question are currently being examined:

1. Dietary overlap – Although the two species may, at specific times of year, consume the same types of plants or occupy the same areas, this does not necessarily mean they are competing. Mule deer have a higher metabolic rate than elk and their internal system is smaller and less efficient. Thus, mule deer require higher quality forage than elk during critical periods. For example, elk can subsist on cured grasses, whereas deer generally cannot. The two species may also avoid direct competition through ecological mechanisms such as spatial or behavioral separation, or they may simply select different plants or plant parts. In spring, elk migrate to higher elevations sooner than mule deer, and they can successfully forage in deeper snow. The actual degree of dietary overlap between mule deer and elk is generally thought to be limited; however, some researchers believe competition for food can have significant impacts in specific situations.
2. Effects of Development – Ranges occupied by mule deer are being physically altered and developed at unprecedented rates across the West. Energy extraction, range conversions, land management decisions, rural subdivisions, and other intensive land uses are displacing deer and elk from preferred habitats and altering their distributions and patterns of use. Deer may be more dependent on specific, traditional winter ranges and habitat conditions to survive. Elk, on the other hand, are more adaptable to change and can travel farther to find adequate habitat. While development and intensive land uses adversely affect both species, mule deer may be impacted to the greater degree.
3. Winter conditions – Elk are better adapted to survive in severe winter conditions. They are much larger and metabolically more efficient; they are more mobile and can forage successfully in deep snow; they can subsist on lower quality forage; and they can withstand more extreme temperatures over longer periods of time. Thus, elk populations are more likely than mule deer to remain at stable levels during sequences of normal to severe winters, especially as the suitability of winter habitats continues to be impacted by human activities. In contrast, most summer ranges are usually sufficiently large and diverse that both elk and deer are able to disperse and find adequate conditions to meet their physiological needs.

4. Biological attributes – Several inherent characteristics of deer and elk populations may affect the outcome of competitive interactions between the species. Elk are longer lived. Although they produce fewer young, their survival rates are high. Elk populations are more stable and less affected by weather patterns. Elk in Wyoming also tend to occupy forested mountainous environments that are less impacted by development. In contrast, mule deer have shorter life spans. They produce significantly more offspring, but survival of mule deer fawns is substantially lower. Mule deer populations fluctuate to a much greater degree than elk populations. Recruitment and survival rates in particular can be extremely variable from year to year. Mule deer tend to occupy shrubland basins, foothills and forest edges, which are changing rapidly as developments and subdivisions encroach. And, mule deer are much more sensitive and less adaptable to changing conditions than are elk.

Researchers continue to study the extent and potential significance of competition between elk and deer. In recent years, elk populations have benefited from changing habitat conditions. Conversely, unfavorable changes in habitat have been the predominant cause of declining mule deer populations. What's less clear is whether mule deer have suffered additionally from competition with elk. Mule deer have also declined in regions where there is little potential for competition with elk. Some, however, predict mule deer are a species headed for extinction due to the competitive nature of elk populations and interactions with white-tailed deer. The Department considers the potential for competition between elk and deer in setting management objectives and in designing habitat improvement projects. However, additional research is needed to better understand whether competition has a significant impact on either species, and to identify specifically how, when, and where competition takes place. The following objectives address potential competition between elk and mule deer:

Objective: Integrate other species' habitat needs with those of mule deer when developing and implementing habitat management plans within mule deer habitats.

Strategy: Coordinate species management programs when developing habitat management plans that will be implemented in important mule deer habitats.

Strategy: Minimize the impacts other species' management plans may have on mule deer populations and habitat.

Objective: Minimize impacts from competing wildlife on mule deer populations.

Strategy: Identify and prioritize mule deer herd units where elk or white-tailed deer populations might have a negative impact on mule deer numbers and distribution.

Strategy: Where significant competition by elk is documented or believed to impact mule deer, develop harvest management strategies to reduce negative interactions with mule deer.

What's been done:

- ✓ *Concerns about elk and mule deer interactions are discussed in “Mule Deer: Changing Landscapes, Changing Perspectives”, published by the Western Association of Fish and Wildlife Agencies (WAFWA).*
- ✓ *Several habitat inventories have been completed throughout the State to identify and correct degraded habitat conditions that may be limiting mule deer. An example is the Meeteetse/Owl Creek mule deer habitat inventory and treatments.*
- ✓ *The Department attempts to manage mule deer and elk herds at or near population objectives to reduce the potential for competition.*
- ✓ *Elk hunting seasons have been liberalized over the past decade in an attempt to stabilize increasing elk populations and to reduce populations that are over objective.*
- ✓ *Organizations including the Mule Deer Foundation and The Rocky Mountain Elk Foundation have cooperatively purchased grazing AUMs (animal unit months) from willing sellers to reduce livestock stocking rates and to retire some key allotments that include important mule deer habitat.*

Public Involvement and Outreach

By any social, cultural, economic, or ecological measure, mule deer are among the most valued of Wyoming's natural resources. To many, the species is a quintessential symbol of the open western landscape. Mule deer are one of the most popular big game species sought by resident and nonresident hunters alike. The Wyoming Game and Fish Department by far sells more deer hunting licenses than it does licenses to hunt any other species. As a result, the sale of deer licenses brings more revenue to the Department than is generated by any other single species.

Deer management entails a myriad of biological considerations. However, we must not neglect the other side of the management equation, human dimensions, which is equally important. Our stakeholders, to whom the resource belongs, are the key to future support and funding of deer management. The Department's public outreach program has three essential objectives – to understand, to involve, and to educate. Through various articles, news releases, and public forums, the public is provided timely information about the biology and ecology of mule deer, the challenges in managing deer and their habitat, and other related issues. Through public participation, one-on-one contacts, and formal opinion surveys, feedback is solicited to understand the public's attitudes and expectations regarding deer management. Finally, the public is provided opportunities to participate in management planning and season setting.

Objective: Understand the public's current knowledge and awareness of important issues affecting mule deer management in Wyoming. Understand the public's opinions and expectations regarding mule deer management and hunting.

Strategy: Conduct public opinion studies to gauge the overall preferences of affected interests as management plans are being developed. Develop regional surveys, based on existing statewide sample frames, to assess hunter knowledge and awareness, opinions, and desires relating to deer management at the local level.

What's been done:

- ✓ *Since 2005, the Department has received data from two survey studies having implications for deer management in Wyoming: Deer and Elk Hunters' Response to Chronic Wasting Disease (2005) and Licensed Deer Hunters' Opinions on and Attitudes Toward Deer Management in Wyoming (2006). These statewide reports provide a broad overview of resident and nonresident hunters' attitudes and values with regard to a variety of issues.*

Objective: Improve the involvement of key stakeholders in management decisions.

Strategy: Utilize various "public participation" techniques to involve the array of interested stakeholders to address the range of issues and desires related to mule

deer and their management when developing management plans for those key herd units identified by the Department.

Objective: Provide timely and accurate information to the public regarding important issues affecting mule deer management.

Strategy: The Department's Information and Education section will draft a communications plan related to the mule deer initiative and subsequent management actions. The plan will identify our target audiences and describe the key messages and communications tools to be used. The plan will likely rely on most of the Department's internal communications tools, including Wyoming Wildlife Magazine, Wyoming Wildlife News, the E-newsletter, website, various video resources, news releases, habitat extension bulletins, and more.

Research

Wildlife research can be broadly typified in two categories – “pure” and “applied.” Pure research is unrestricted in the sense that it can address subjects ranging from highly theoretical aspects to basic characteristics of an organism or its environment. Applied research, on the other hand, seeks to answer specific questions needed to resolve a problem or to improve our ability to manage a resource. Pure research has produced a great deal of information that is useful to the science of wildlife management and often serves as a foundation for applied research. However, most investigations conducted or supported by the Department address applied management questions.

Many problems and issues confronting mule deer management are not well understood, at least, beyond a conceptual level. Habitat conditions, natural vegetation succession, human developments, energy extraction, land management practices, weather and climate changes, disease, predation, competition with other wildlife species and other factors have in some combination contributed to the general decline in mule deer across the West. Through monitoring and field studies, managers are improving their understanding of how mule deer are being affected. This knowledge will assist us in designing more effective management and mitigation programs, and in justifying to companies and land management agencies why mitigation is needed to offset the impacts of development. Managers also need to be sure the management practices we are currently recommending, and those considered in the future, are effective. Accordingly, research is being done throughout mule deer range to document whether management practices are producing desired results. Practices that are ineffective should be discontinued so available resources can be dedicated to more effective strategies.

Mule deer distribution, habitat use, and movement patterns are studied so management is focused where it is most needed. Related research seeks to identify the specific environmental factors that limit the size and health of a mule deer population. This type of information enables us to better predict whether a proposed development is likely to have a significant impact at the population level, and provides a basis to select the most effective locations for habitat treatments or mitigation projects. The emergence of diseases such as CWD pose additional management challenges for the future. Research is being done to examine how they are transmitted, the extent to which they may impact populations, and how such diseases can be controlled or eliminated. Finally, investigating better, cost efficient means to reliably estimate population size, mortality, and other vital factors is critical. Better survey techniques will ultimately increase the public’s confidence in harvest management decisions and improve our ability to monitor populations.

Ultimately, sound management decisions must be founded in good science. Research is an essential component of any progressive management program.

Objective: Improve our understanding of mule deer ecology and management.

Strategy: Periodically update the Department's research priorities.

Strategy: Maintain a liaison and cooperative working relationships with the Wyoming Cooperative Wildlife Research Unit (COOP Unit), other departments at the University of Wyoming, and other research institutions. Support adequate staffing and funding for the COOP Unit.

Strategy: Secure an adequate budget and outside support to fund the Department's highest research priorities.

Strategy: Within the Department, create a support position that can assist personnel with study designs and statistical analyses for Department-conducted research, and can collaborate with other entities in conducting Department-sponsored research.

What's been done:

- ✓ *The Department is the principal agency cooperator working with the University of Wyoming's Cooperative Research Unit. We provide funding, technical and logistic assistance, and identify and prioritize research needs.*
- ✓ *The Department also conducts research on a limited basis.*

Objective: Identify the most important factors affecting mule deer survival and recruitment, and estimate the extent they affect populations.

Strategy: Monitor and assess annual survival of adult females.

Strategy: Assess pre-winter body condition and weight of mule deer fawns to predict over-winter survival.

Strategy: Compare survival of mule deer among herd units throughout the State to estimate annual mortality rates of age and sex classes and to assess the factors determining productivity of different herds.

Strategy: Evaluate shifts in distribution and habitat use as a result of competition with elk.

Strategy: Evaluate the degree competition with elk affects mule deer productivity and survival.

Strategy: Evaluate predation impacts on survival of mule deer fawns and more importantly, recruitment to adult age classes. Set up properly designed studies in various habitat types throughout the State.

Strategy: In areas where predators may be having a significant impact on mule deer populations, assess how predation may be changing age/sex composition of the population.

What's been done:

- ✓ *The Department has undertaken several investigations to assess factors affecting annual and seasonal movements of mule deer. Studies have been done in the Redeye Basin (Green River Region), the Rattlesnake Hills (Casper Region), and near Meteetsee (Cody Region).*
- ✓ *The Department is cooperating with research consultants, Federal agencies, and energy development companies to assess distribution shifts and survival of mule deer does in the Pinedale Anticline and Baggs area oil and gas fields.*

Objective: Investigate the impacts of human development.

Strategy: Implement research statewide and regionally to address impacts of: 1) energy development, 2) vehicle and train collisions, 3) highway construction, 4) fence construction, 5) reservoir construction, and 6) large-scale shrub control projects and rangeland conversions.

Strategy: Assess impacts of housing and subdivision construction, and human-caused habitat fragmentation within mule deer migration corridors and crucial habitats.

What's been done:

- ✓ *The Department is cooperating with research consultants, Federal agencies, and energy development companies to study mule deer impacted by the Pinedale Anticline and Baggs area oil and gas fields. These studies will document the effects intensive natural gas development have on survival and distribution of adult mule deer that winter in this area.*
- ✓ *The Pinedale Anticline and Hickey Mountain oil and gas development projects were designed to identify impacts to local mule deer populations and to determine appropriate mitigation.*
- ✓ *Department personnel are working with the Wyoming Department of Transportation (WYDOT) and local conservation groups in the Jackson Hole area to develop a plan that will minimize vehicle collisions with mule deer along the Jackson to Dubois and Jackson to Star Valley highways.*
- ✓ *The Department is working with WYDOT to construct wildlife underpasses along the mule deer migration corridor in Nugget Canyon (Green River Region). These underpasses will allow mule deer, elk, and pronghorn to pass safely beneath the highway. Once the underpasses are complete, they will prevent up to 200 mule deer from being killed by vehicles each year in Nugget Canyon.*

Objective: Improve survey methods and other techniques used to estimate size and trends of mule deer populations.

Strategy: Determine the levels of adult female survival and recruitment that lead to population changes in representative areas. Apply this information to improve the Department's population simulation models.

Strategy: Evaluate and compare various methods used by other states to survey deer populations (quadrat sampling, herd composition surveys, sightability surveys, etc.).

Strategy: Evaluate the reliability of annual winter mortality surveys.

Strategy: Evaluate the reliability of computer simulation models for estimating sizes of mule deer populations and for tracking population trends.

Strategy: Assess the reliability of applying weather data to modify mortality and survival estimates used in estimating annual mule deer population size and trend.

What's been done:

- ✓ *The Department and WEST have applied the quadrat sampling procedure to census mule deer populations on winter ranges occupied by the Sublette mule deer herd. To control costs, a systematic sample (grid) is surveyed.*
- ✓ *During the late 1980s, the Department compared the accuracy of postseason classifications conducted from a helicopter versus the ground. No significance differences were detected.*
- ✓ *Mortality surveys are done each spring in western Wyoming to determine over winter survival of mule deer.*
- ✓ *The Department is evaluating techniques used by other wildlife agencies to estimate mule deer population size.*

Objective: Study habitat selection by mule deer.

Strategy: Evaluate how bucks age 2+ utilize hiding and security cover in relation to its availability during the hunting season.

Strategy: Evaluate whether there is significant overlap in the habitats selected by female deer and elk when they give birth and during first several weeks afterward. Determine if competition for reproductive habitat impacts productivity of mule deer.

Objective: Improve our knowledge of how various vegetation management techniques affect mule deer and their habitat.

Strategy: Evaluate vegetation and mule deer response to various applications of prescribed fire and other treatment techniques in sagebrush steppe, mountain shrub, aspen, conifer and riparian habitats.

Objective: Assess the effects of hunting on the various age/sex classes of mule deer.

Strategy: Determine age and sex-specific mortality rates during hunting seasons.

Strategy: Compare harvest field check and harvest survey data to determine if there are age or sex reporting biases in the harvest survey and to estimate their importance.

Objective: Investigate susceptibility of free-ranging mule deer populations to diseases.

Strategy: Evaluate the prevalence, transmission, and spread of diseases such as CWD and EHD, and the potential for an effective vaccine.

Strategy: Investigate other methods to reduce population wide effects of these diseases.

Funding and Support

The Department expended more than \$4.7 million to fund deer management in 2005. Data collection and enforcement constitute the greatest expenses in each of the 39 mule deer herds. In addition, the Department foresees three critical needs that will require significant additional funding in the future: 1) Landscape-scale habitat management; 2) Energy impact analysis and mitigation; and 3) Disease research and management.

Much of the Department's current emphasis is directed toward conserving and enhancing habitat conditions for mule deer. This effort involves habitat monitoring throughout the state, involvement in land use planning processes, and participation in collaborative projects to protect and improve mule deer habitats.

The Department has increasingly recognized habitat must be comprehensively managed on a landscape basis if mule deer herds are to be sustained at levels desired by the public and in balance with available habitat. To achieve this, land use plans must address the ecological requirements of all species including mule deer. Habitat treatments must also be implemented at a scale sufficient to realize population-level responses by mule deer. These efforts will require significant new sources of funding as well as cooperative partnerships with industry, private landowners, federal agencies, and nongovernmental organizations (NGOs). Collaborative partnerships are the most effective means to enhance funding from new and traditional funding sources. Several such funding sources include the Wyoming Wildlife and Natural Resource Trust Fund, Energy Company Mitigation and Donations, Mule Deer Foundation, Safari Club International, Tri-State Safari Club, Wyoming Governor's Big Game License Coalition, Federal Agency Funding Appropriations, Federal Farm Bill Programs, Sportsmen for Fish and Wildlife, Wyoming Wildlife Federation, Rocky Mountain Elk Foundation, Wyoming Game and Fish Trust Fund, Bow Hunters of Wyoming, The Nature Conservancy, and various other Conservation Groups.

Unprecedented rates of energy development continue to be a major focus in Wyoming. It is imperative we understand the extent to which this development is affecting mule deer populations and how the impacts can be mitigated. Energy companies are likely the most appropriate entities to fund special studies and contribute financial resources needed to mitigate habitat losses.

The potential impacts of CWD and the mechanisms by which the disease is spread are not well understood. There will be substantial costs incurred as we endeavor to understand this disease and its future implications for mule deer management.

Objective: Continue to fund the Department's mule deer management program at an effective level. Continue to fund priority research on mule deer and their habitat.

Strategy: Continue allocating sufficient fiscal and logistic resources to adequately manage mule deer and their habitat in Wyoming. The interest in mule deer and the importance of revenues generated to the State and the Department warrant continued focus on this species.

What's been done:

- ✓ *In 2005, maintenance and operations expenditures for the Department's mule deer management program totaled about \$4,735,000. This budget was similar in 2006 and will likely increase in upcoming years.*
- ✓ *The Commission has annually appropriated about \$200,000 to support research by the University of Wyoming Cooperative Wildlife Research Unit. This research addresses a myriad of wildlife topics including subjects related to mule deer management.*
- ✓ *The Department formed a Mule Deer Working Group to address mule deer management issues in Wyoming.*
- ✓ *The Department actively participates on the Western Association of Fish and Wildlife Agency's Mule Deer Committee.*

Objective: Seek new sources of funding to implement landscape scale habitat treatments, conduct research related to energy development and mitigation, and manage CWD.

Strategy: Develop collaborative partnerships with NGO's, government agencies, and private companies to solve the funding challenges now faced by the Department.

What's been done:

- ✓ *Habitat Extension Biologists in Wheatland, Gillette, Casper, and Greybull are funded through a partnership with the Natural Resource Conservation Service (NRCS).*
- ✓ *The Jonah Interagency Office in Pinedale was created in partnership with the Federal Government and Industry to implement mitigation programs that will address wildlife habitat impacts arising from large-scale energy development.*
- ✓ *Several Department personnel serve on NGO Project Advisory Committees (MDF, RMEF, FNAWS, etc.) to leverage funding for habitat improvement projects in Wyoming.*
- ✓ *General fund money has been appropriated by the legislature for the Department's Vet Services program and the Wildlife/Livestock Disease Partnership. This has enabled the Department to increase our surveillance and research of wildlife diseases.*
- ✓ *The Department has assigned personnel who serve as liaisons to numerous NGOs.*
- ✓ *The Commission is partnering with Federal land management agencies, landowners, and NGOs, with the support from the general public, to leverage*

Federal, state, and private funding sources to implement the Wyoming Landscape Initiative. This Initiative will develop a science-based, strategic program to enhance wildlife habitat on a landscape scale in southwest Wyoming.

Strategy: Evaluate a “Grants Writer” position to more effectively pursue funding from outside sources.

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APPENDIX 1

Mule Deer Feeding Criteria and Logistics for Emergency Feeding

Dated: April 23, 2009

MULE DEER FEEDING CRITERIA

INTRODUCTION: Wildlife managers have struggled with developing quantifiable methods of determining when and if to feed deer during extreme weather conditions for some time. Discussions often focus on balancing extremely difficult logistics and high costs, with the realization that emergency feeding often results in minimal success in influencing overall survival of deer herds that are fed. We have provided a qualitative approach to making the decision as to whether or not to begin feeding. Although there may be a strong desire to replace the human element with a quantitative approach, we do not believe data can replace the professional assessment of each situation as it unfolds on the ground. We have developed a set of guidelines we believe will assist managers faced with making the decision to feed deer.

Criteria to determine when to begin Emergency Deer Feeding:

Primary Criterion:

Predicted winter-related mortality likely exceeding 30% of the adult female segment of the population. The secondary criteria that managers will consider include the following:

Secondary Criteria:

1. Seventy percent or more of winter forage is unavailable due to snow depth, crusting conditions, or because a catastrophic event such as fire has removed forage. This will be determined through ocular estimation of winter ranges. These conditions will be considered more significant the earlier they occur in the winter.
2. Daytime temperatures are below 0 degree Fahrenheit for a minimum of 5 consecutive days.
3. Long-term weather forecasts suggest no amelioration of conditions within the foreseeable future.
4. Fall body condition score on adult (≥ 2 years) road-killed or harvested deer averages <10 based on the body condition score (Lutz et al. 1997). This indicates essentially no fat deposition on the rump at the base of the tail.

The secondary criteria listed above will be evaluated to assess if any population under review is at risk of the 30% loss identified under the primary criteria. These items will be considered together to predict mortality rates. Not all data is available for all herds.

In addition to those criteria listed above, managers will also consider the following when assessing the final decision as to whether to begin an emergency feeding operation.

1. Feeding shortstops migrations of deer to traditional winter ranges.
2. Significant fawn mortality detected.
3. Productivity on key shrubs is below the previous 5-year average and resulting browse will result in 100% use of current annual growth.
4. Increased threat to human safety.

The Wildlife Division Chief will confer with the affected regions and will be responsible for the final decision whether to initiate emergency feeding operations.

Frequency of Feeding:

By reviewing the primary criterion for the Platte Valley and Wyoming Range herds, we can predict that over the past 30 years we would have potentially met the 30% mortality criterion for these two populations three times. These include the 1978-79 winter, the 1983-84 winter, and the 1992-93 winter.

WINTER FEEDING LOGISTICS

INTRODUCTION: Any emergency feeding operation would take a large-scale coordinated effort, including the dedication of necessary funds, manpower, and organizational skills to accomplish the task. This document is intended to provide guidance to department personnel and the Commission when faced with the decision to initiate emergency feeding. It is broken into five sections, including command center, equipment, feed, personnel, and coordination with other agencies and landowners. Much of this is based on recent experience of the Colorado Division of Wildlife and we have used this experience as the basis of our plan.

Command Center:

If the decision was made to feed, Wildlife Administration would use an “Incident Command” style system to manage and oversee feeding operations similar to how the United States Forest Service (USFS) manages fire-fighting operations. Emergency funding would be sought from the Commission and once approved, an incident command person would be appointed to oversee the operation. Additional staff would be assigned to the project by Wildlife Administration. This person would meet with feed operation staff and make assignments relative to the overall operation (Attachment A).

A command center would be set up and a large photo hierarchy of the operation outlining who was responsible for each task would be posted. The command center would also track feeding/baiting sites, feed order/distribution, equipment locations, equipment conditions, damage locations, volunteer signup, and costs. Large topographical maps of feed sites and access roads would be printed and displayed in the command center.

In the event a feeding operation is implemented near or in a regional office town, the command center could be the regional office. In the event a regional office could not be used, the department would need to rent a space for this purpose. Some possibilities include churches, city meeting rooms, conference centers, or homes/apartments. The department would also need storage space to protect various supplies from the weather. Not having a specific location in mind, portable pods (8' x 20' x 8') would be suitable to store excess feed and various tools, small equipment, etc. A local storage rental could be utilized, as well.

Equipment:

The department would need to dedicate much of its current equipment inventory to adequately initiate a deer-feeding operation. Equipment needs will vary depending on the size of the feeding

operation and topography of terrain. The Department has the following equipment that would need to be available to initiate a deer feeding operation:

- Two snowcats
- Thirty snowmobiles
- Numerous 4-wheel drive trucks
- Twenty snowmobile trailers
- One front-end loader
- Cell phones
- Portable radios
- Truck radios

Snowcats would be used for large feed delivery, baiting elk away from feed sites, and moving personnel to and from feeding sites. Snowcats could also be used to pack down snow at feeding sites, allowing animals to walk on top of the snow. Snowmobiles would be used to deliver deer feed to feeding sites. Snowmobiles work well because they can be easily loaded, unloaded and moved between feeding sites in a short amount of time.

The Department does not have the following equipment and would need to lease, contract, or purchase:

- Heavy lift helicopter service for aerial hay drops
- Helicopter service for aerial flights
- Sleds to haul feed behind snowmobiles
- Dumpster roll-off for excess garbage (feed sacks & carcasses)
- Storage pods to keep feed dry
- Snow grader to keep roads open as necessary

Heavy lift helicopters would be used to distribute hay into remote areas. Colorado Division of Wildlife (CDOW) used Heliquest International out of Montrose, Colorado. Our contact for Heliquest International is Chris Darst, (307) 213-4335 (office) or (970) 596-6445 (cell). Heliquest International has two offices, one located in Cody, Wyoming and one in Montrose, Colorado. Heliquest International has two helicopters available for heavy lift operations, depending on the weight to be lifted. Their B2A-Star helicopter can lift 1,100 to 1,200 pounds and costs approximately \$1,600 per hour. Their Bell 205 helicopter can lift 2,400 pounds and costs approximately \$3,000 per hour. The average large square bale of hay weighs between 900-1,200 pounds. The heavy lift helicopters can drop a single load of hay in about twenty minutes, carrying the load fifteen miles to the drop site and back to the loading site, 30 miles round-trip, averaging two to three loads an hour. Ferry time would also be included for the helicopter to travel from Cody or Montrose and back to their base. Ferry time from Cody to Pinedale is approximately 1-2 hours and from Montrose to Pinedale is approximately 2-3 hours. Mr. Darst thought these flights could be scheduled with a one-day notice, depending on how busy they were.

Aerial flights would also be needed to monitor big game movements and locate isolated big game animals. Pull-behind sleds would be beneficial to haul bags of feed to and from the feed

sites. Every effort should be made to keep the equipment in working order, having personnel or a contracted mechanic nearby to service equipment, as well as have spare equipment on reserve.

Feed:

Most research indicates the wafer or pellets CDOW has formulated are the most effective feed for mule deer. CDOW contracted Ranch-way Feeds in Fort Collins, Colorado to produce their deer feed; formula # E4020GP. This is the only deer feed Ranch-way Feeds has produced on a large scale for state agencies. The contact is Bill Conrad at 970-482-1662. Ranch-way Feeds can produce deer feed with seven days notice and quoted the price at \$335/ton, bagged in 50 lb. feed sacks. Delivery prices for deer feed delivered to two regional offices, Casper and Pinedale, would be \$45 per ton. A loaded semi-truck can haul approximately twenty-three tons per load. Twenty-three tons of bagged feed delivered would cost a total of \$8,740; \$7,705 in feed and \$1,035 for delivery based on current prices.

In 2008, CDOW estimated feed costs for feeding a target goal of 8,000 deer was \$2,880 per day, at 2 lbs. of feed per deer/day or \$86,400 per month. CDOW estimated at the peak of activity they were feeding 9,600-9,800 deer, 450+ pronghorn, and 3,400+ elk (bait away from other feed sites) at 131 sites. At peak activity and a daily ration of 2 lbs/day, deer were being fed 564 bags of feed (approximately 28,200 pounds of feed or 14 tons) at a cost of approximately \$5,076 per day for deer feed, not including personnel or equipment. The amount of deer feed fed during the winter of 2007-08 was 838 tons, costing approximately \$293,000. The amount of hay used during the same time was 880 tons (\$180 per ton), costing approximately \$158,400. Hay was used to bait elk away from deer feeding sites and to help draw deer and antelope into the feeding sites.

Personnel /Volunteers:

The department would assign personnel to work on a deer feeding operation, similar to our task force operations. Personnel would be needed from every region and possibly other divisions, greatly affecting normal department operations. Efforts would be made to utilize local personnel to hold down costs of lodging, per diem, and travel. Based on the CDOW feeding operation in Gunnison, we would need at least 50 personnel each day if we conducted most of the operations with our staff. This equates to almost 100 department personnel assigned to work in alternating schedules to allow personnel to take time off. Personnel would work seven days on and seven days off. We estimate the department would spend approximately 45,000 hours on deer feeding with an operation the size of the one Colorado conducted, which lasted 130 days. Typical feeding operations would start mid-morning with picking up feed bags, traveling to the feeding sites, distributing the feed, traveling to the next site until all the sites have been fed, and returning to the command center. Feeding operations should only be conducted during daylight hours to avoid injuries due to low light conditions and extreme temperatures.

Four to five people would be assigned to work in the command center, working on logistics, fiscal, data entry, radio dispatch, and other related tasks. The remaining 46 personnel would work as two-person teams, feeding five to six feeding sites a day.

CDOW fed deer in the Gunnison area for about 130 days continuously at 131 feeding sites, logging more than 22,000 CDOW department hours. Volunteers reported 4,925 hours, but due to non-reporting the total was believed to be closer to 10,000 hours. Feeding the 131 sites utilized 60-80 volunteers and 20+ CDOW personnel each day. Volunteers played a large role in the CDOW feeding operation, feeding deer at sites that were easy to access by foot or on skis.

CDOW personnel typically fed from snowmobiles with a two-person team, one operator and one person feeding off the back of the snowmobile. These two-person teams worked in alternating schedules in four-day shifts, allowing for constant self-retraining to a new individual. This was crucial so local CDOW personnel would not have to train new personnel for site location, feeding amounts, and landowner contacts.

Jay Wenum, CDOW, estimated expenses for the Gunnison deer feeding operation as of 5/9/2008 at approximately \$2.25 million. This estimate includes personnel time, equipment, feed, and other associated costs, but the final numbers were not available as of this paper. Breakdown of the CDOW expenses are as follows: \$1.6 million for equipment, feed, and other materials and \$617,000 for personnel. A further breakdown of equipment and feed expenses shows \$526,000 was spent on deer feed and hay, \$226,000 on damage material (elk panels), \$430,000 on a heavy lift helicopter (moving hay), and \$240,000 on snowcats/snowmobiles (purchased two snowcats and four snowmobiles). Pull-behind snowmobile sleds were also purchased for approximately \$270 per sled.

We have provided two estimates of cost for a similar operation in Wyoming (Attachment B). The first estimate assumes the entire operation is done with department personnel only and the second depicts use of volunteers and half the department staff. Costs are detailed by major category but the overall estimates are \$2.8 million and \$2.1 million respectively. These are only estimates but we believe they are reasonable based on the Colorado experience.

Coordination With Other Agencies and Landowners:

The department would need to work with other state and federal agencies to initiate a plan for feeding on areas that might be affected by recreational closures on winter ranges, or that may have restrictions on use of equipment, personnel, etc. Agencies include the Bureau of Land Management (BLM), USFS, State Land Board, Wyoming Department of Transportation (WYDOT), County Road and Bridge Departments, and County Sheriff's Offices. Local game wardens and biologists will coordinate with landowners to secure access on and through properties, if applicable. The department will coordinate with state and county agencies to maintain access to feeding areas via county roads. In addition, it may be necessary to have WYDOT plow areas off the shoulder of the roadway to allow department personnel to have a pull-off to load and unload equipment. Feeding operations are of great public interest and, therefore, extensive media coverage might be expected. The department would direct all media interaction through local I&E personnel, similar to CDOW feeding operation in Gunnison, CO.

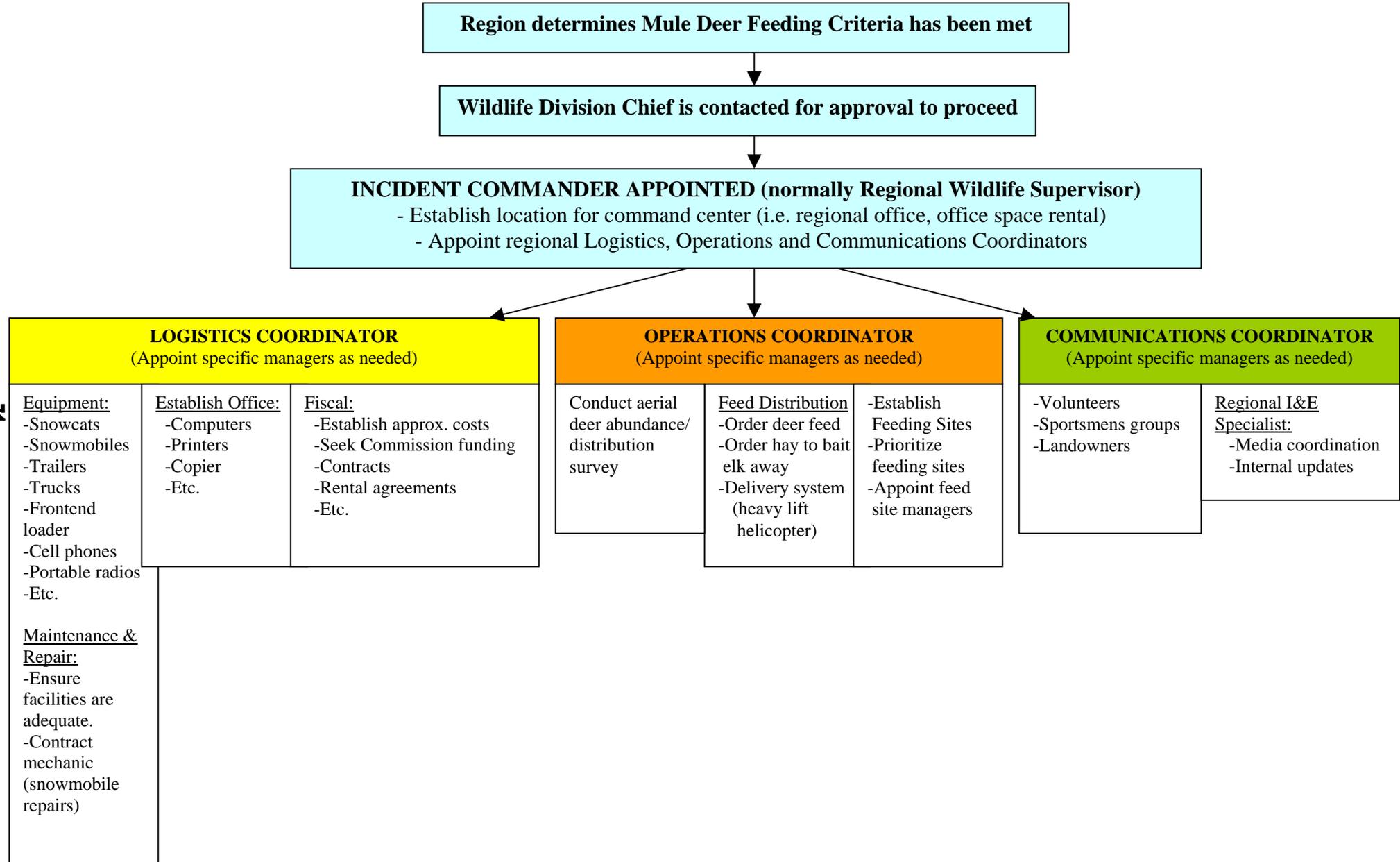
Conclusion:

Initiating emergency feeding would take an enormous department effort. Cost estimates are over \$2 million for feed and equipment and normal department operations would be greatly affected during the operation. An incident command approach would be used to oversee such an operation and emergency funding would have to be sought. Department personnel, as well as volunteers, would be used to conduct the operation, depending on scale. Extensive department equipment would be needed to conduct the operation and helicopter service would be needed to move feed and locate starving animals.

Wildlife Division

Flowchart - Emergency Mule Deer Feeding

Attachment A



ATTACHMENT B					
MULE DEER WINTER FEEDING - LOGISTICS					
	Deer Feeding Operation				
	Dept Personnel Only	Feeding 130 days			
Personnel					
50 personnel needed daily	Hours (Averaging \$20/hour)	45,000 hours			\$900,000
	Lodging (130 nights *25 rooms*\$91/night)				\$295,750
	Per diem (\$54/per person/day)				\$351,000
				Personnel Total	\$1,546,750
	Deer Feeding Operation				
	Using Volunteers	Feeding 130 days			
Personnel					
25 Dept. personnel needed daily	Hours (Averaging \$20/hour)	22,500 hours			\$450,000
	Lodging (130 nights *25 rooms*\$91/night)				\$147,875
	Per diem (\$54/per person/day)				\$175,500
60-80 volunteers	Misc. expenses				\$50,000
				Personnel Total	\$823,375
Feed & Hay					
	Deer Feed: 838 tons (\$335/ton)				\$280,730
	Hay: 880 tons (\$140/ton)				\$123,200
	Deer Feed delivery (\$45/ton, * 838 tons)				\$37,710
				Feed & Hay Total	\$441,640
Equipment			Hourly Rate		
	Snowcats (2 operational)	1,560 hours (2 machines x 6hr/day x 130 days)	\$34.80/hr		\$54,288
	Snowmobiles (30 machines)	23,400 hours(30 machines x 130 days x 6hr/day)	\$4.21/hr		\$98,514
	Helicopter Service (40 hours)	(40 hours flight, 1 flight per week for approximately 2 hours)	\$550/hr		\$22,000

	Heavy lift Helicopter service (Dropping once a week, at four sites, dropping 3 loads/hr (6 bales/hr)	(19 days x 7 hours/day x \$3,000/hr)	\$3,000/hr		\$399,000
	3/4 ton trucks	(400 miles (travel to & from) x 50 trucks x 19 weeks) =380,000 miles (commuter miles), (100 miles (feeding) x 25 trucks x 130 days) = 325,000 miles (work/feeding miles) = 705,000 miles	\$0.31/mile		\$218,550
	Snowmobiles pull behind sleds (\$270 per sled *20)				\$5,400
	Front end loader (1 unload hay)	390 hours (130 days x 3 hours/day)	\$18.34/hr		\$7,153
	Vehicle Accessories (tire chains, tow ropes, shovels, etc)				\$2,500
	Dumpster rolloff (\$300 per unload, 30 cubic yard)				\$1,000
				Equipment Total	\$808,405
Misc.	Contractual services (welding, mechanical, etc.)				\$20,000
	Landfill (carcass disposal)				\$1,000
	Office rental (\$3500 per month x 4 months)				\$14,000
	Office supplie (paper, maps, copies, etc.)				\$2,500
	Storage rental ((8'x8'x20' pods \$125/month) 2 pods x 4 months)				\$1,000
				Misc. Total	\$38,500
		Dept. Personnel Only		Total	\$2,835,295
		Using Volunteers		Total	\$2,111,920